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A Profile of Advanced Manufacturing in the Cape and Islands Region: Key Industry and Occupational Trends

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Executive Summary

This report provides a detailed examination of Advanced Manufacturing in the Cape and Islands region. This report is part of an eight-part series, each focusing on different areas of the Commonwealth. It examines recent employment and earnings trends; analyzes key occupations in Advanced Manufacturing's subsectors, looking for common labor needs and comparing wages to similar workers in other industries; identifies the most common and critical skills needed by employers; and offers a detailed demographic profile of Advanced Manufacturing to highlight areas of critical concern for the future health of the industry.

The Advanced Manufacturing sector has an almost negligible presence in the Cape and Islands. Its fewer than 2,000 workers comprise less than 2% of the total regional employment base. The largest subsectors are Computers and Electronics and Food Processing, but no subsector constitutes a clear regional specialization. Advanced Manufacturing workers in the region also tend to make less than their counterparts elsewhere in the state. Only workers in Computers and Electronics earn substantially more than the regional average, and most subsectors have witnessed little real wage growth since 2001.

Like most other regions, the Advanced Manufacturing sector in the Cape and Islands has witnessed net job losses and layoffs since 2001. However, due the sectors limited presence in the region the relative impact of these loses has been rather muted compared to other areas. Most of the major losses were associated with recessionary periods in 2001-02 and 2008-09. Since 2010, the Advanced Manufacturing sector has added net new jobs to the regional economy at a pace commensurate with national sectoral growth, although the actual number of jobs is still small.

The limited size of the core Advanced Manufacturing labor pool and the irregular geography of the region challenges the cost-effective development of training programs that typically benefit from scale advantages and concentrated demand. While workers across the different subsector share many key occupations and skill requirements, workforce development officials may have to develop programs that appeal to a wider spectrum of industries. The aging of the Advanced Manufacturing workforce also poses a major challenge to the region. The labor force of the Cape and Islands is among the oldest in the state. Almost 60% of today's workforce will reach retirement age within the next twenty years—and there are few workers in their twenties and thirties to fill these openings. On the plus side, the Advanced Manufacturing workforce in the Cape and Islands is more diverse in its gender and racial composition that what we typically find elsewhere in the state and region.

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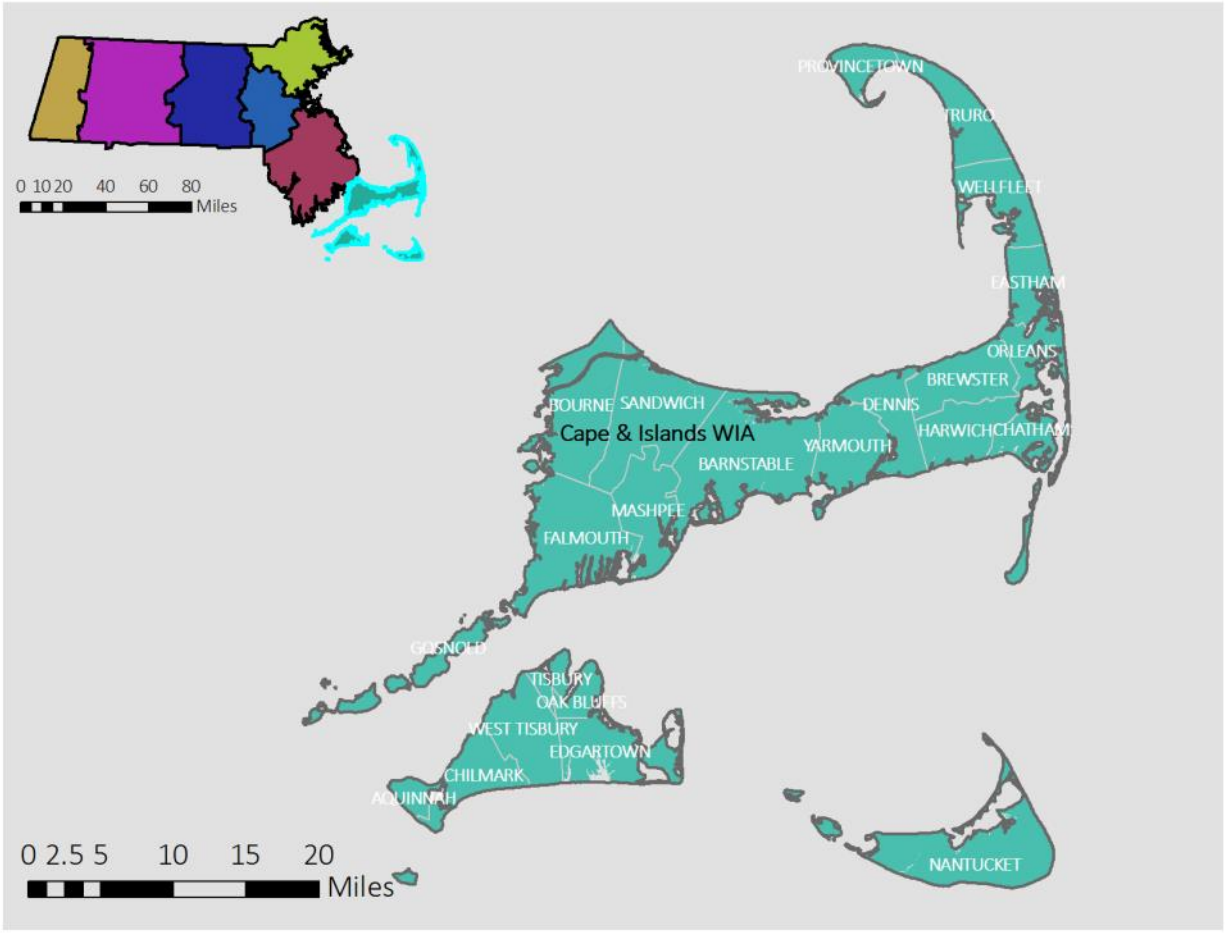
Introduction

Study Purpose and Scope

This report provides a detailed examination of the industrial ecology and occupational composition of Advanced Manufacturing in the Cape and Islands region (Figure 1). Its purpose is to provide up-to-date and actionable information to help guide policy and program decisions directed to securing a strong future for the region's Advanced Manufacturing sector. The industry definitions of the Advanced Manufacturing sector are provided in Appendix A. A more in-depth discussion on the rationale behind these definitions is provided in the state-level companion profile titled "A Profile of Advanced Manufacturing in the Commonwealth: Key Industry and Occupational Trends."

This report is one of seven regional profiles of the Advance Manufacturing sector (Appendix B). This report focuses on industry and occupational trends within the Cape and Islands region, including compari-

Figure 1
The Cape and Islands Region



sons to state and national trends to help put the recent performance of the region's Advanced Manufacturing sector in a larger context. While this report is designed to stand alone, we highly encourage readers to also examine the state-level profile, which provides additional detail on definitions, methods and data sources; as well as providing comparisons across all of the seven designated regional labor markets.

This report follows a similar template and format as the state-level study. It opens with a review of recent industrial trends: employment, wages and salaries, and the impact of the recent recession and recovery in the Cape and Islands region. Next, we move on to a detailed examination of the most prominent and specialized (i.e. "core") occupations in Advanced Manufacturing sector and its component subsectors. We also consider crossover occupations that are prevalent in multiple industries within Advanced Manufacturing, which provide likely targets for training programs that offer the greatest benefit to the most employers. We next examine the specific types of skills used and required by these core occupations. Skills transcend both occupations and industries, and thus regrouping occupations in terms of complimentary and similar skills provides another venue for identifying possible targets for training and other development programs.

This report closes with a detailed demographic profile of the people that work in Advanced Manufacturing in the Cape and Islands region. We pay particular attention to areas of critical concern for the future health of the industry, such as the aging of the workforce, the gender gap, commuting patterns, educational attainment, and the prevalence of foreign born workers. Our demographic profile uses similar data sources and many common metrics covered by the recent regional labor force profiles of the Federal Reserve Bank of Boston[2]. It differs in that our analysis focuses solely on the Advanced Manufacturing workforce, while theirs covers the entirety of the labor market, with only limited coverage of workers in specific industries.

Industry Trends in the Cape and Islands Region

There is very little Manufacturing in the Cape and Islands region, advanced or otherwise. As of 2012, there were approximately 136 establishments and 1,770 employees in the region's Advanced Manufacturing sector (Table 1). This is less than 2 percent of the region's total employment base—far below expected levels based on national shares and the smallest of any of the seven profiled region's in Massachusetts (Figure 2).

As with all regions in the Commonwealth, the Cape and Island's Advanced Manufacturing sector suffered major losses in recent years, continuing long term trends of decline. The Advanced Manufacturing sector lost a net of nearly 600 jobs since 2001, a decline of 37%. While these losses represent a significant erosion of the region's manufacturing base, they had relatively little impact on the overall regional economy. The relative burden of these losses is the lowest of any of the seven study regions, equivalent to a loss of roughly one percent of the entire regional employment base (Figure 3).

Recent employment trends in the Cape and Islands are not entirely negative. In fact, the Advanced Manufacturing sector actually added net new jobs in five of the eleven years since 2001. However, the net job gains were clearly outweighed by its losses. The job losses of the past twelve years were heavily concentrated in the first four years of the millennia. The highest single-year decline was between 2001 and 2002, with

Table 1
Employment, Establishment, and Earnings Summary by Major Industry Sectors, 2012

	Establishments			Employment			Real Wage and Salary Earnings*	
Sector	Number	Change from 2001	Average Size	Number	Change from 2001	Location Quotient	per Worker	Change from 2001
Advanced Manufacturing	136	-29	13.0	1,770	-599	0.28	$57,198	$16
Other Manufacturing	82	-38	4.8	393	-503	0.13	$40,942	-$8,193
Natural Resources and Mining	91	3	4.9	442	57	0.28	$40,778	-$539
Construction	1,500	267	4.3	6,394	-268	1.40	$53,206	$956
Trade, Transportation and Utilities	2,381	-165	9.4	22,468	-1,307	1.07	$34,732	-$1,079
Information	203	9	9.7	1,959	-499	0.87	$47,174	-$5,963
Financial Activities	752	-59	5.3	3,987	-1,169	0.66	$61,385	$7,382
Professional and Business Services	1,754	174	5.5	9,618	-224	0.67	$53,941	$2,688
Education and Health Services	963	130	26.0	25,041	3,928	1.02	$50,313	$4,646
Leisure and Hospitality	1,677	19	12.9	21,653	1,630	1.92	$24,966	-$372
Other Services	1,262	217	3.8	4,798	749	1.32	$31,082	$390
Public Administration	233	38	26.3	6,123	316	1.06	$59,209	$3,618
Total, all industries	11,034	566	9.5	104,647	2,114	1.00	$42,276	$1,050

*Measured in 2013 dollars

Source: Massachusetts Department of Labor, Quarterly Employment and Wages (ES-202), Author's Calculations

a drop of 261 net jobs. Another 187 jobs were lost in the following year (Figure 4). But after 2003 job losses abated, and between 2005 and 2008 the region actually added a small number of new jobs each year. The recession of 2008 brought two more years of declining employment. By 2010, the Advanced Manufacturing sector was, again, adding net new jobs to the regional economy.

The lower portion of Figure 4 plots annual employment growth in the Cape and Islands against national trends to identify whether regional employment trends are due primarily to broader market or technological conditions or are indicative of a region-specific advantage or disadvantage. The region's Advanced Manufacturing sector lagged national trends of decline during the first few years of the millennia, but slightly exceeded national trends during the middle and

Figure 2
Regional Distribution of Advanced Manufacturing Employment

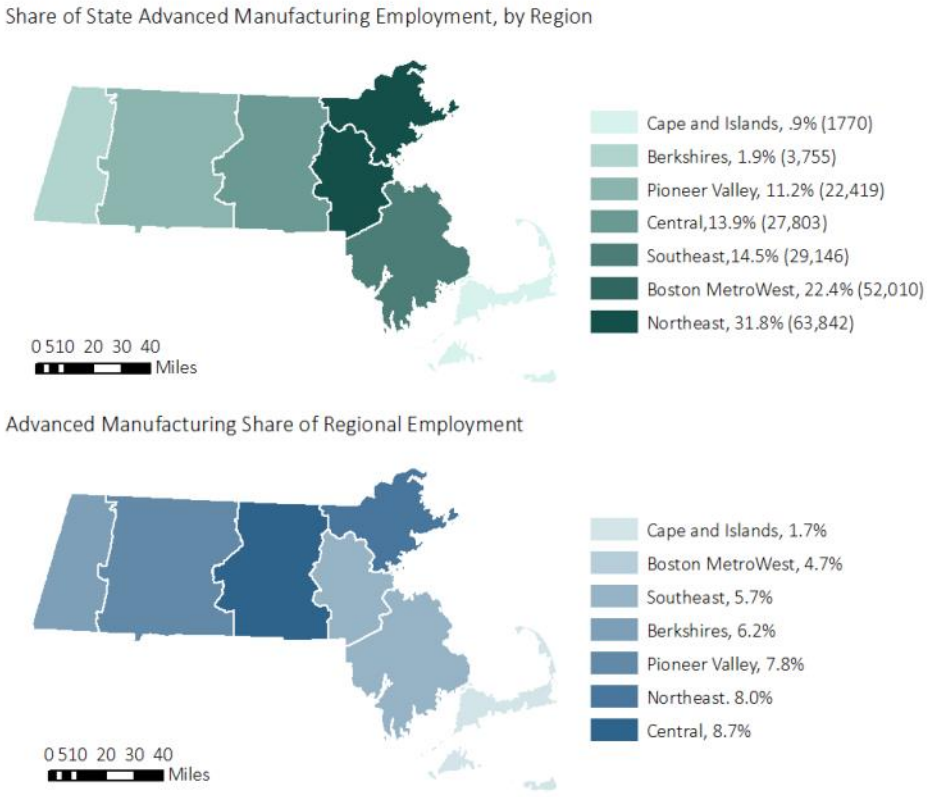
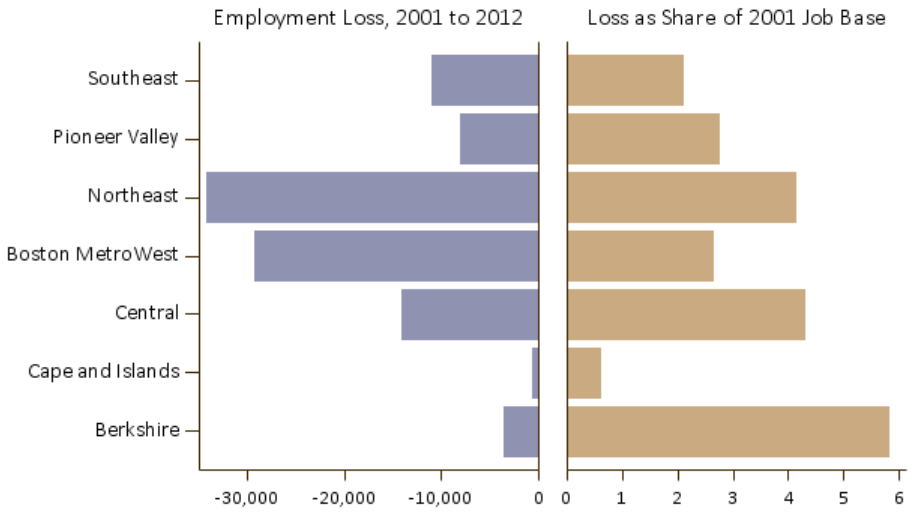


Figure 3
Regional Distribution of Job Losses in Advanced Manufacturing

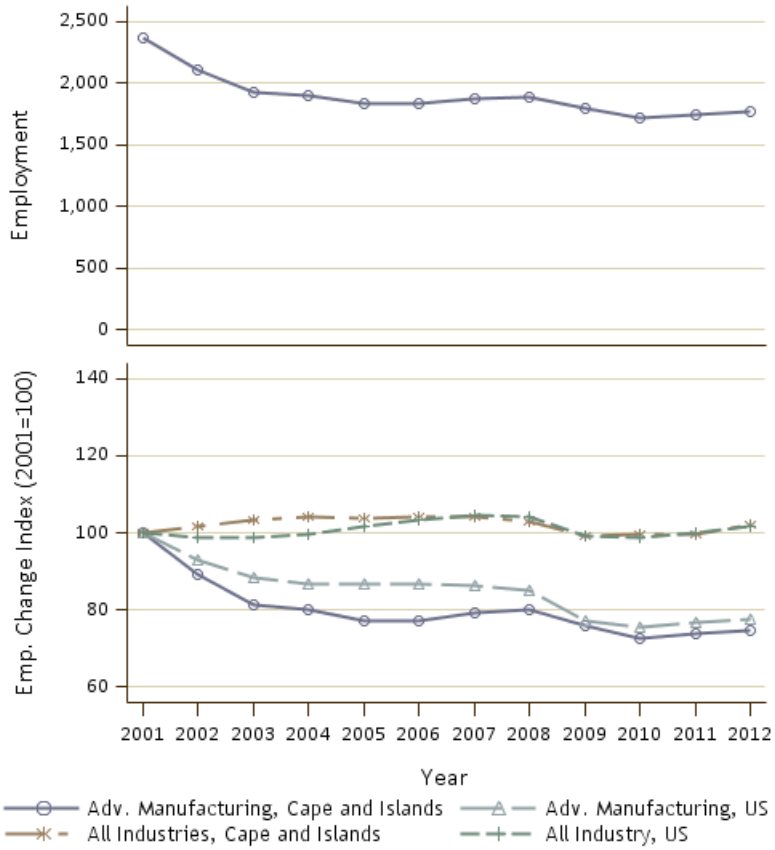


Source: Massachusetts Department of Labor, Quarterly Employment and Wages (ES-202), Author's calculations

latter portions of the decade. The region essentially matches the nation in the relative magnitude of its job growth during the post-recession recovery.

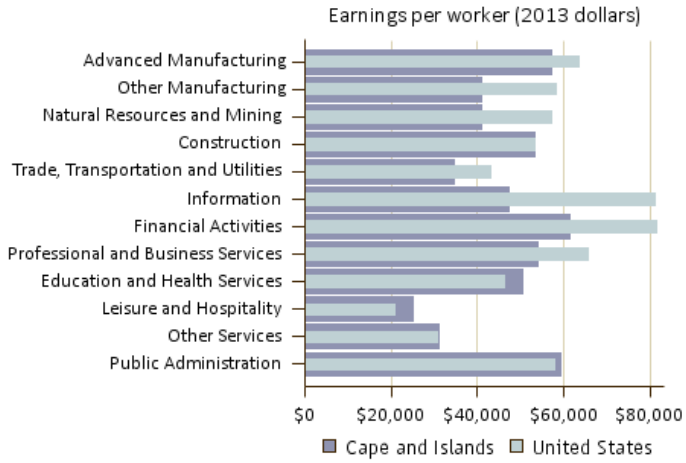
Although small, the Advanced Manufacturing sector of the Cape and Islands region continues to be an important source of regional income and wealth. The Cape and Islands region is particularly dependent upon its Leisure and Hospitality and Construction sectors—the latter being largely oriented towards the building and renovation of second and vacation homes. The region lacks a firm employment base in locally-rooted industries that can provide a secure income to its year-long residents. Advanced Manufacturing plays an important role in this respect. Wages and salaries in the Cape and Islands' Advanced Manufacturing sector tend to be among the lowest in the state and below national standards (Figure 5). Yet Advanced Manufacturing workers in the Cape and Islands still earn nearly $15,000 more than the overall regional average, and are notably higher than other key sectors, such as Leisure and Hospitality and Trade (Table 1). On the downside, wage growth in the region's Advanced Manufacturing sector has generally lagged the nation, particularly in the first half of the decade (Figure 6).

Figure 4
Annual employment change in Advanced Manufacturing, 2001 to 2012



Source: Massachusetts Department of Labor, Quarterly Employment and Wages (ES-202), Author's calculations

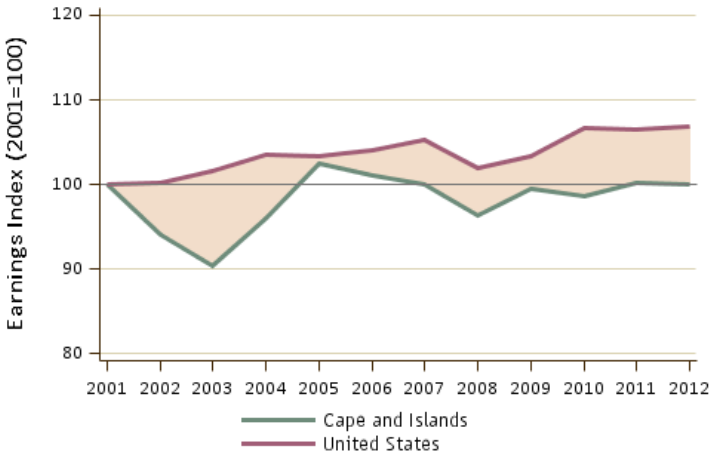
Figure 5
Average Earnings per Worker (2012),
Cape and Islands Region compared to the Nation



Source: Massachusetts Department of Labor, Quarterly Employment and Wages (ES-202), Author's calculations

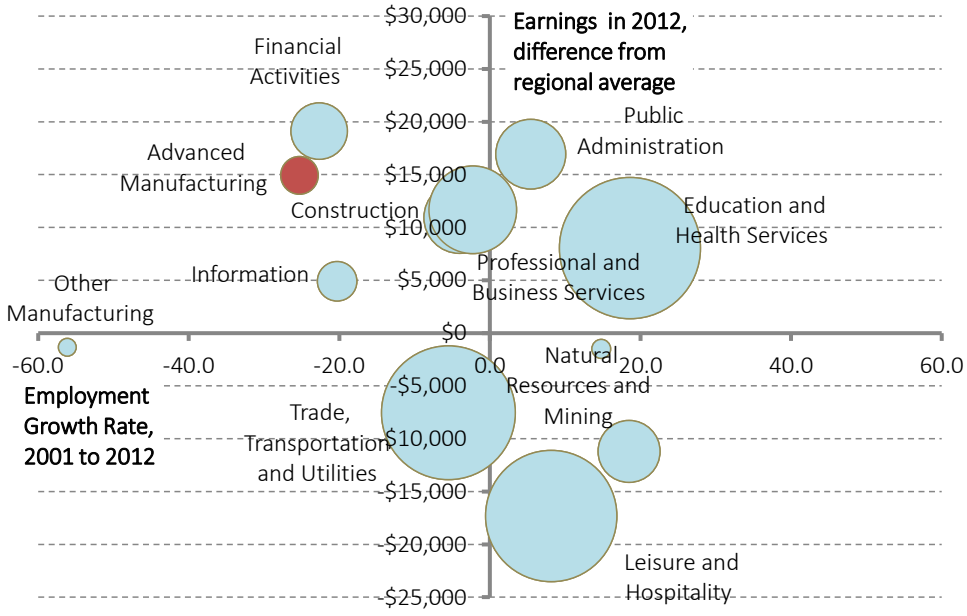
Figure 7 helps put recent employment and wage trends into perspective, by plotting relative earnings per worker (vertical axis) against the rate of employment growth (y-axis), for each major industry sector. The size of each bubble is scaled according to its 2012 employment level. Advanced Manufacturing clearly suffered major job losses in the years since 2001, relative to its size. Yet it is among the highest-paying sector in region, and pays more than all but one of the other major sectors that added jobs since 2001.

Figure 6
Trends in Real Earnings per Worker in Advanced Manufacturing, Cape and Islands Region vs. the U.S., 2001 to 2012



Source: Massachusetts Department of Labor, Quarterly Employment and Wages (ES-202), Author's calculations

Figure 7
Major Industry Sectors, by Average Earnings, Size, and Growth



Advanced Manufacturing Subsectors in the Berkshire Region

Table 2
Employment, Establishment, and Earnings Summary by Advanced Manufacturing Sub-Sectors, 2012

	Establishments			Employment			Real Wage and Salary Earnings*	
Sub-sector	Number	Change from 2001	Average Size	Number	Change from 2001	Location Quotient	per worker	Change from 2001
Chemicals and Plastics	9	-1	24.7	222	-129	0.215	$63,940	$2,790
Computers and Electronics Products	20	1	29.9	598	-168	0.514	$80,547	-$4,129
Fabricated Metals & Machinery	31	1	7.3	225	-28	0.113	$63,629	$7,109
Food Processing and Production	42	-12	11.6	486	-52	0.374	$28,617	-$419
Medical Equipment and Supplies	11	-4	8.8	97	-90	0.397	$46,869	$348
Paper and printing	23	-14	6.2	142	-132	0.212	$43,023	$4,632
Advanced Manufacturing (total)	136	-29	13.0	1,770	-599	0.276	$57,198	$16

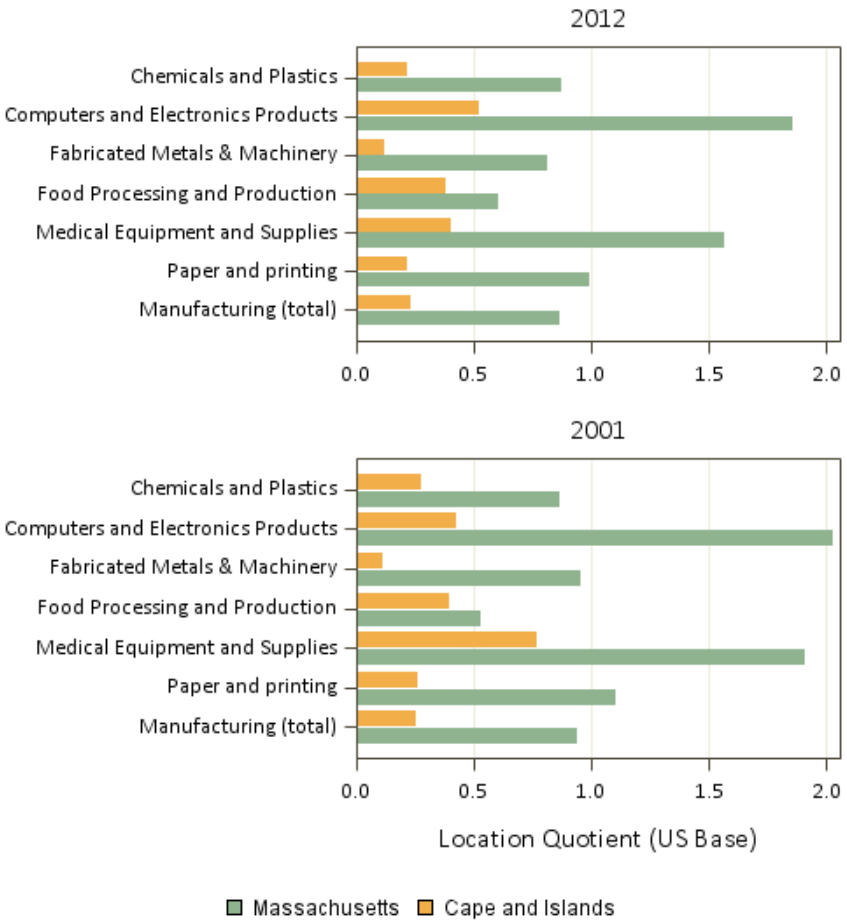
*Measured in 2013 Dollars

Source: Massachusetts Department of Labor, Quarterly Employment and Wages (ES-202), Author's Calculations

Establishments, Employment and Regional Specializations

The Cape and Islands has no significant specialization in any of the seven individual subsectors (Table 2, Figure 8). All have employment shares far below the national share. Of the seven, the largest subsector is Computers and Electronics Manufacturing with just under 600 employees. Establishments in Computers and Electronics are larger than other subsectors in the region, averaging 30 workers per establishment. But compared to similar Computers and Electronics firms in other parts of the Commonwealth, establish-

Figure 8
Relative Concentration of Employment by Advanced Manufacturing Subsector, Cape and Islands vs. the Commonwealth



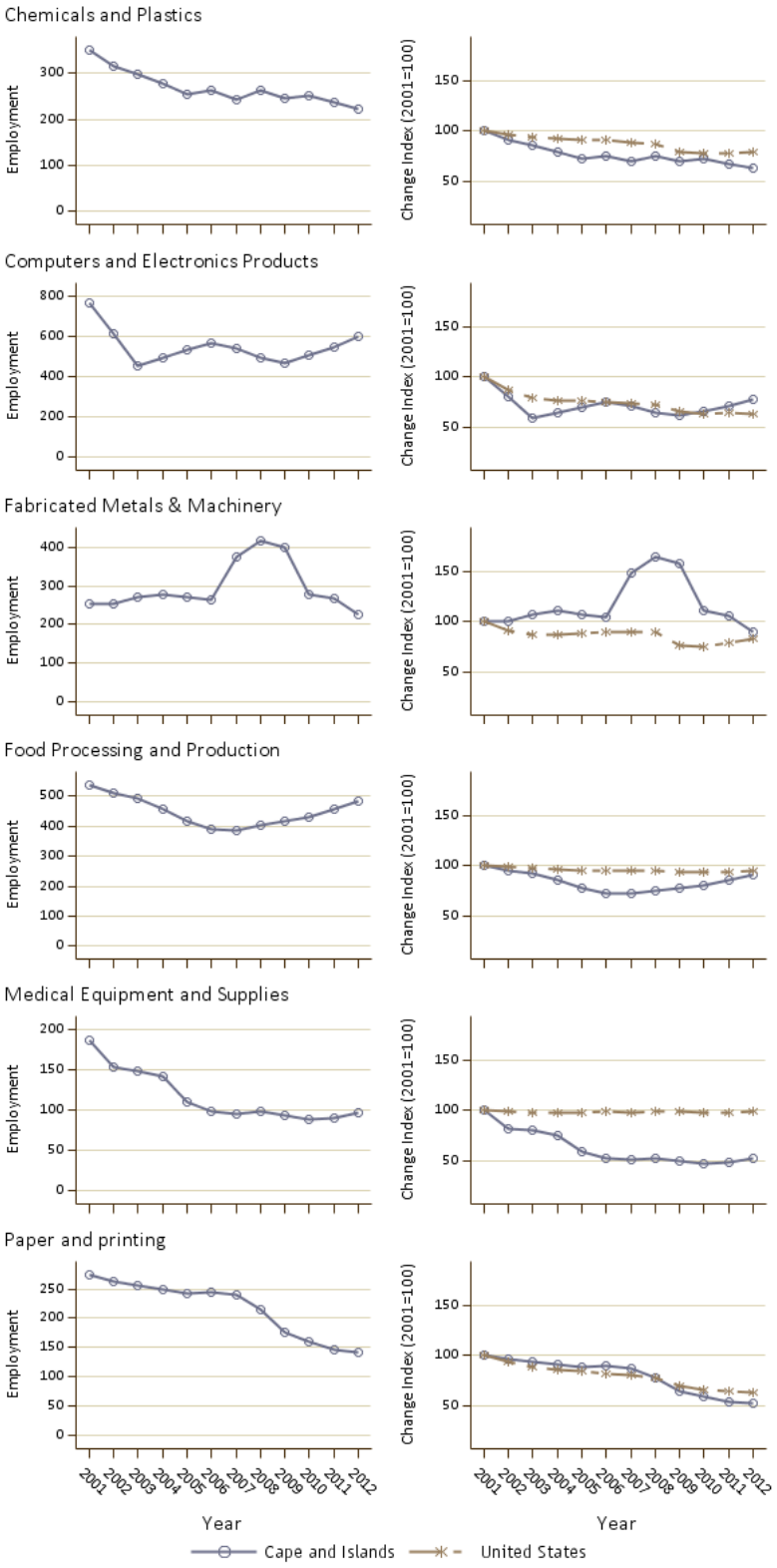
Source: Massachusetts Department of Labor, Quarterly Employment and Wages (ES-202), Author's calculations

ments in the Cape and Islands are much smaller. Food Processing and Production is the second largest subsector with just under 500 employees as of 2001. While it hires fewer workers, Food Processing has more establishments—although the typical establishment is very small (7 employees per establishment). The smallest subsector is Medical Equipment and Supplies, which has fewer than 100 workers spread over 11 establishments (Table 2).

Employment Trends

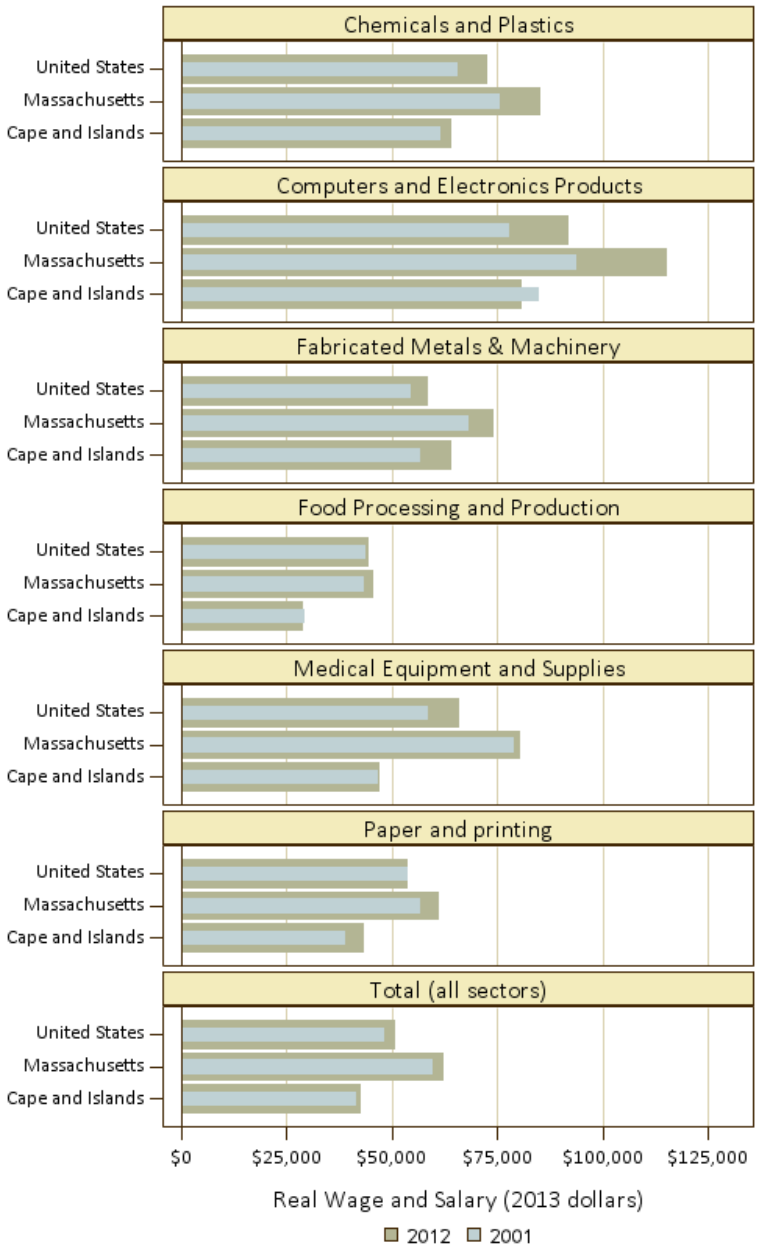
Each of the seven subsectors had net employment decline since 2001, but these losses were largely concentrated in the early years of the millennia. Keeping in mind that year to year employment and wage trends can be a bit erratic in small economies, where the ad-hoc hiring or layoff decisions of even a single employer may lead to abrupt changes from one year to the next. Still, there are positive signs in several sectors. The Computer and Electronics Products and Food Processing and Production subsectors both added jobs since the mid-2000's, making up for much of the losses of the first half of the decade (Figure 9). Medical Equipment and Supplies lost a large share of its employment base between 2001 and

Figure 9
Employment Change by Selected Subsectors, Cape and Islands Region



Source: Massachusetts Department of Labor, Quarterly Employment and Wages (ES-202), Author's calculations

Figure 10
Annual Earnings per Worker, 2001 to 2012



Source: Massachusetts Department of Labor, Quarterly Employment and Wages (ES-202), Author's calculations

2005, but appears to have stabilized since. Chemicals and Plastics and Paper and Printing show more consistent decline over the entire study period. The Paper and Plastics subsector seems to have been hit particularly hard by the 2008 recession and may only now be beginning to recover. Fabricated Metals and Equipment basically held steady over the past twelve years, with the exception of a notable 'blip' in the second half of the 2000s. However, this is likely to simply be a temporary aberration from an otherwise flat long-term trend.

Earnings and Wage Trends

Wage rates in the Cape and Islands region's Advanced Manufacturing sector tend to lag both the nation and state (Figure 10). Only in Fabricated Metals and Machinery do regional wages match or exceed the national average. Fabricated Metals and Paper and Printing are also the only two subsectors where recent wage growth has kept pace with the Commonwealth. Real earnings have been essentially flat in Medical Equipment and Supplies and Food Processing. Wages in Computers and Electronics appear to have declined slightly since 2001. However, it is unclear whether this is result of layoffs of more highly paid workers, thus lowering the statistical average, or whether wage growth just hasn't kept pace with inflation.

Occupational Profile of the Advanced Manufacturing Subsectors

This section profiles the knowledge, skills and abilities of the Advanced Manufacturing labor pool in the Cape and Islands. It follows a similar structure and format as the companion state-level occupational profile—focusing on the specific occupations identified at the "core" of the Commonwealth's Advanced Manufacturing sector. But there are some important differences. Several of the key data sources used to analyze occupations by industry are only available on a statewide basis. At the regional level, data is limited to total (cross-industry) employment and wage figures by occupation. In other words, the figures discussed in this section include not only workers in Advanced Manufacturing, but workers doing similar jobs in other industries, as well. And while these are considered core occupations in Advanced Manufacturing, the number of workers actually working in Advanced Manufacturing may be far less. Yet, we feel that this analysis does provide an accurate portrayal of the *potential* Advanced Manufacturing workforce, otherwise referred to as the labor pool, because it covers occupations with generally similar skills and aptitudes as those found among workings in the industry.

We begin with a brief profile of the entire regional labor force, classified by major occupational groups that are most closely related to Advanced Manufacturing. We follow with a closer examination of the specific core occupations of the Advanced Manufacturing sector as a whole. The section closes with a brief discussion of employment and wage trends for occupations considered core to the six individual Advanced Manufacturing subsectors.

Regional Occupational Structure

Table 3 presents total employment in the Cape and Islands region across major occupational categories—focusing on those previously identified as particularly prevalent in the Commonwealth's Advanced Manufacturing sector. The largest share of the region's labor force are in office and administrative support occupations (16.1%) —in line with the state and most other regions. The Cape and Islands also has a large number of workers in food preparation and serving (14,130) and sales and related occupations (12,380) which along with high concentrations in construction (1.22) and building and grounds cleaning and maintenance (1.64) occupations, are reflective of the region's core industries of leisure and hospitality, tourism and retail, and real estate oriented activity. Of other note, a high concentration of scientists are located in the regional labor pool; likely related to the several marine based research institutes in the region. Yet our state level analysis of the Commonwealth shows that production occupations are the most special-

Table 3

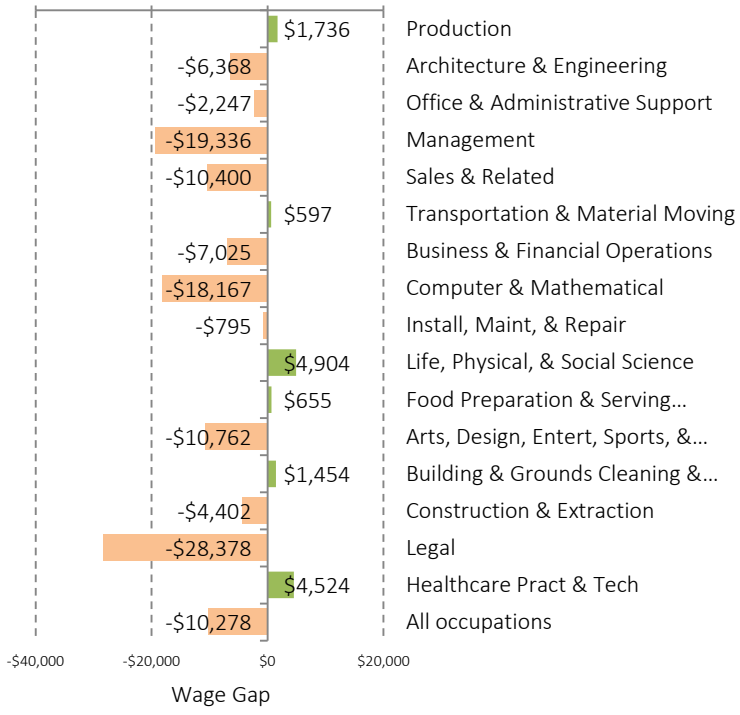
Major Occupational Groups within Advanced Manufacturing and total regional employment, 2012

SOC	Occupational Category	Region wide Workers	Industry Share	Location Quotient	Annual wage
51-0000	Production Occupations	2,130	2.1%	0.32	$39,854
17-0000	Architecture and Engineering Occupations	980	1.0%	0.54	$77,997
43-0000	Office and Administrative Support Occupations	16,080	16.1%	0.98	$37,718
11-0000	Management Occupations	4,080	4.1%	0.83	$104,166
41-0000	Sales and Related Occupations	12,980	13.0%	1.22	$34,899
53-0000	Transportation and Material Moving Occupations	4,810	4.8%	0.71	$36,502
13-0000	Business and Financial Operations Occupations	2,800	2.8%	0.57	$71,079
15-0000	Computer and Mathematical Occupations	890	0.9%	0.32	$73,491
49-0000	Installation, Maintenance, and Repair Occupations	3,930	3.9%	1.01	$50,200
19-0000	Life, Physical, and Social Science Occupations	1,220	1.2%	1.44	$82,451
35-0000	Food Preparation and Serving Related Occupations	14,130	14.1%	1.59	$26,370
27-0000	Arts, Design, Entertainment, Sports, and Media Occupations	1,090	1.1%	0.81	$47,808
37-0000	Building and Grounds Cleaning and Maintenance Occupations	5,360	5.4%	1.64	$33,734
47-0000	Construction and Extraction Occupations	4,670	4.7%	1.22	$52,320
23-0000	Legal Occupations	340	0.3%	0.43	$81,015
29-0000	Healthcare Practitioners and Technical Occupations	6,500	6.5%	1.11	$86,112
00-0000	Total all occupations	100,180	100.0%	1.00	$45,878

Source: MA Office Labor and Workforce Development (EOLWD) OES, author's calculations. Includes Major SOC categories with occupations in Advanced Manufacturing indicated by the state report. Wages in 2013 dollars.

Figure 11

Difference in major occupational category earnings, Region v. MA



Source: MA EOLWD, OES; US BLS, OES; author's calculations. In 2013 dollars.

ized to the Advanced Manufacturing sector. The Cape and Island region's share of production occupations is relatively small compared to national distributions. With a location quotient of just .32, the lack of core workers in Advanced Manufacturing follows the relative small presence of the sector in the Cape and Islands.

Workers in production occupations earn higher wages than the regional average at about $40,000, as do scientists and to some extent food preparation occupations. On average, workers in architecture or engineering earn a somewhat less than the broader labor pool; diverging from most other regions (Figure 11).

Advanced Manufacturing Core/Crossover Occupations

Table 4 reports the core/crossover occupations of the Advanced Manufacturing sector that were identified in our state-level analysis. Occupations that are "core" in a particular subsector are designated by an "X". Table 4 also includes regional employment totals for each occupation, as well as subsector industry employment levels (as reported in the previous section) to provide a sense of each subsector's contribution to the region's Advanced Manufacturing base. It is important to note that the industry employment numbers

Table 4
Summary Employment and Core Advanced Manufacturing Crossover Occupations, 2012

SOC	Occupational Title	Region wide workers	Chem. and Plastics	Comps. and Elect.	Fab. Metals and Mach.	Food Process. & Prod.	Medical Equip. and Supplies	Paper and Printing
11-9041	Architectural & Engineering Managers	50	x	x	x		x	
51-4011	Computer-Controlled Machine Tool Operators, Metal & Plastic	NA	x	x	x		x	
51-4031	Cutting, Punching, & Press Machine Setters, Operators, & Tenders, Metal & Plastic	30	x	x	x		x	x
17-3023	Electrical & Electronics Engineering Technicians	50		x	x		x	
51-2023	Electromechanical Equipment Assemblers	NA		x	x		x	
51-4021	Extruding & Drawing Machine Setters, Operators, & Tenders, Metal & Plastic	NA	x	x	x			
51-1011	First-Line Supervisors of Production & Operating Workers	190	x	x	x	x	x	x
51-9198	Helpers--Production Workers	NA	x	x	x	x	x	x
17-3026	Industrial Engineering Technicians	NA	x	x	x			x
17-2112	Industrial Engineers	30	x	x	x		x	x
49-9041	Industrial Machinery Mechanics	70	x	x	x	x	x	x
11-3051	Industrial Production Managers	NA	x	x	x	x	x	x
51-9061	Inspectors, Testers, Sorters, Samplers, & Weighers	50	x	x	x	x	x	x
51-4041	Machinists	NA	x	x	x		x	
17-2141	Mechanical Engineers	70	x	x	x		x	
51-4072	Molding, Coremaking, & Casting Machine Setters, Operators, & Tenders, Metal &	NA	x	x	x			
51-4081	Multiple Machine Tool Setters, Operators, & Tenders, Metal & Plastic	NA		x	x		x	
51-9111	Packaging & Filling Machine Operators & Tenders	NA	x			x		x
51-2092	Team Assemblers	70		x	x	x	x	x
51-4111	Tool & Die Makers	NA	x		x		x	x
		Share	12.5%	33.8%	12.7%	27.5%	5.5%	8.0%
		Number	222	598	225	486	97	142

Source: Massachusetts EOLWD, OES and ES-202 data series; author's calculations

include only those workers specific to the subsector, regardless of occupation. Whereas the occupational employment totals report all workers in the region, and not just those in Advanced Manufacturing.

The high level of data suppression in the region makes it difficult to identify cross sector patterns in the core crossover occupations (Table 4), as a number of these occupations have either suppressed or no employment in the region. Nevertheless, there is a handful of occupations that are represented in four or more subsectors in the region, with particular emphasis on engineering related occupations as well as some machine oriented workers. Given the small scale of Advanced Manufacturing in the region, training and workforce development initiatives might be targeted towards more adaptive skill sets that allow workers in the region to be more versatile across a range of job or industry types. Furthermore, identifying occupational and skill commonalities with similar industry sectors outside Advanced Manufacturing may also create some opportunities for worker mobility.

Chemicals and Plastics

While the subsector shares a number of 'core/crossover' occupations with other subsectors, Chemicals and Plastics differs in its share of workers in scientific fields, such as chemists, biologists, and similar types of engineers that have somewhat specialized knowledge relative to other subsectors. Given the size of the region, the core labor pool of Chemical and Plastics is rather small. Table 5 displays total occupational employment and wage trends in the Cape and Islands region for the occupations identified as core to the Chemicals and Plastics subsector that are reported for the region. As limited as the core occupations are, there is somewhat wide representation of the types of workers characterized in the subsector statewide. Occupations include supervisors, science based technicians, and inspectors, testers, sorters, samplers, and

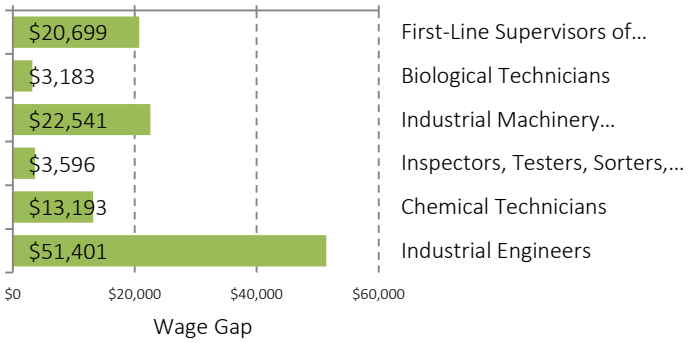
Table 5
Summary Employment and Earnings Statistics, Key Occupations in Chemicals and Plastics, 2012

		Employment			Real Wage	
SOC	Occupational Title	Number	Change from 01	Location Quotient	Per worker	Change from 01
19-4021	Biological Technicians	190	110	3.40	$49,061	$979
51-1011	First-Line Supervisors of Production and Operating Workers	190	80	0.43	$66,577	$4,305
49-9041	Industrial Machinery Mechanics	70	-	0.30	$68,419	$17,306
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	50	-90	0.14	$49,474	$3,744
17-2112	Industrial Engineers	30	-	0.18	$97,279	-
19-4031	Chemical Technicians	30	-	0.64	$59,071	-

Source: Massachusetts EOLWD, OES; author's calculations. Wages in 2013 dollars.

weighers, which are shared across several other subsector labor pools. Reflective of Advanced Manufacturing in the region, most occupations are highly underrepresented in the region relative to the nation, with the exception of biological technicians, which is highly concentrated. These workers are most likely shared with marine and research industries and may likely undertake very different types of work than that required in the Chemicals and Plastics subsector.

Figure 12
Difference in occupational earnings for workers in Chemicals and Plastics v. regional average wage across all workers



Source: MA EOLWD, OES; author's calculations. Wages in 2013 dollars.

Wages of the core labor pool are, on average, significantly higher than the region wide average. Likewise, real wages of workers in the core labor pool have increased since 2001, with industrial machinery mechanics experiencing significant increases over the period, though this may be a direct result of increases these workers in other industries that have seen periods of strong growth since 2001, such as in construction.

Computers and Electronics

The types of workers in the Computers and Electronics subsector typically include a large number of computer, math and engineering occupations—occupations that tend to require a high degree of skill and knowledge as well as some post-secondary education. Table 6 displays the total industry occupational employment and wage trends in the Cape and Islands region for the occupations identified as core to the Computers and Electronics subsector. The core labor pool is somewhat more diverse and comprised of a larger number of occupations compared to other subsectors. A number of occupations related to electrical work are present in the core labor pool. In particular, electro-mechanical technicians are very highly concentrated in the region relative to national shares of these types of workers. Most of the other core labor pool occupations are somewhat underrepresented, in line with the small relative presence of the subsector in the region. Overall, employment has decreased across most all core labor pool occupations since 2001.

For the most part, wages for the core Computers and Electronics labor pool are significantly higher than the regional average. The exception is team assemblers, who earn substantially less than the regional average (Figure 13). In general, real wages have increased since 2001 in a nearly all core labor pool occupations,

Table 6
Summary Employment and Earnings Statistics, Key Occupations in Computers and Electronic Products, 2012

SOC	Occupational Title	Employment			Real Wage	
		Number	Change from 01	Location Quotient	Per worker	Change from 01
51-1011	First-Line Supervisors of Production and Operating Workers	190	80	0.43	$66,577	$4,305
15-1132	Software Developers, Applications	140	-	0.31	$63,160	-
17-3024	Electro-Mechanical Technicians	110	60	8.42	$63,844	$11,578
15-1133	Software Developers, Systems Software	80	-	0.27	$107,950	-
17-2141	Mechanical Engineers	70	0	0.36	$76,061	-$9,695
51-2092	Team Assemblers	70	-260	0.09	$28,194	-$11,719
11-9041	Architectural and Engineering Managers	50	-20	0.35	$143,266	$25,353
17-2071	Electrical Engineers	50	-90	0.41	$95,626	$10,328
17-3023	Electrical and Electronics Engineering Technicians	50	-60	0.45	$61,882	$3,941
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	50	-90	0.14	$49,474	$3,744
17-2072	Electronics Engineers, Except Computer	40	0	0.39	$91,749	$7,141
17-2112	Industrial Engineers	30	-	0.18	$97,279	-
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment	30	-30	0.59	$53,713	-$6,401

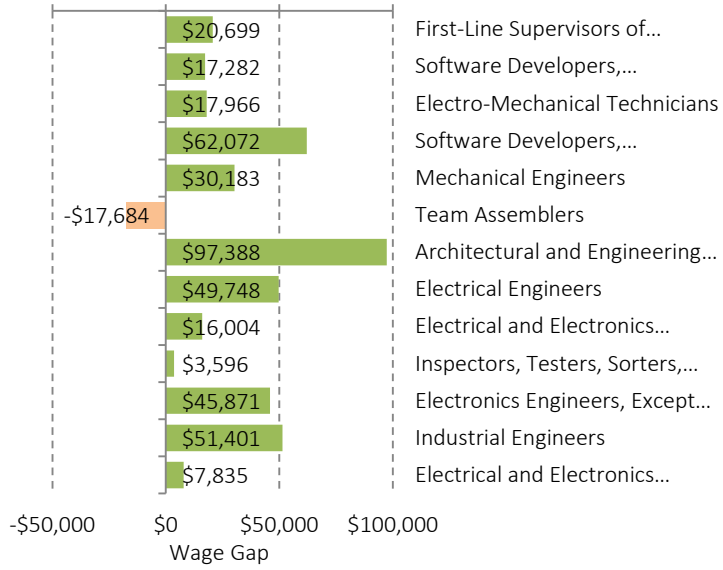
Source: Massachusetts EOLWD, OES; author's calculations. Wages in 2013 dollars.

though team assemblers saw wages decrease by a third (Table 7).

Fabricated Metals and Machinery

Relative to other subsectors, Fabricated Metals and Machinery has the highest concentration of 'production' oriented occupations, which comprise about half of the total workforce in the subsector statewide. These include workers that use machining, tools, and other tangible processes to complete work. The subsector also employs a number of engineering-based occupations.

Figure 13
Difference in occupational earnings for workers in Computers and Electronics v. regional average wage across all workers



Source: MA EOLWD, OES; author's calculations. Wages in 2013 dollars.

The occupations reported for the core labor pool in the Cape and Islands region are reported in Table 7. The core labor pool is comprised of several machine operators and engineers as well as the more ubiqui-

Table 7
Summary Employment and Earnings Statistics, Key Occupations in Fabricated Metals and Machinery, 2012

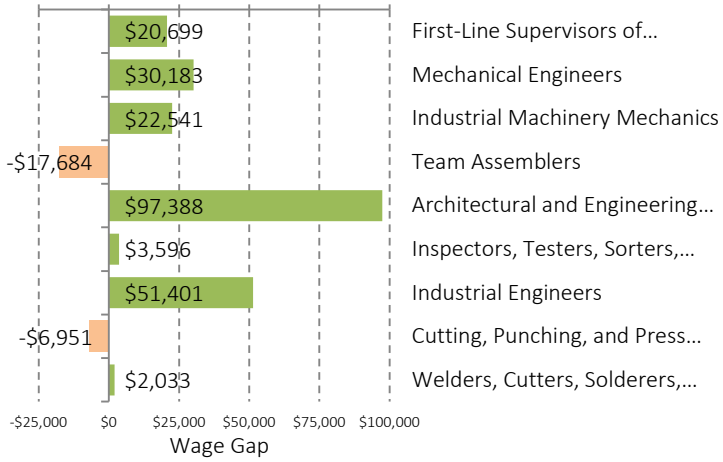
		Employment			Real Wage	
SOC	Occupational Title	Number	Change from 01	Location Quotient	Per worker	Change from 01
51-1011	First-Line Supervisors of Production and Operating Workers	190	80	0.43	$66,577	$4,305
17-2141	Mechanical Engineers	70	0	0.36	$76,061	-$9,695
49-9041	Industrial Machinery Mechanics	70	-	0.30	$68,419	$17,306
51-2092	Team Assemblers	70	-260	0.09	$28,194	-$11,719
11-9041	Architectural and Engineering Managers	50	-20	0.35	$143,266	$25,353
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	50	-90	0.14	$49,474	$3,744
17-2112	Industrial Engineers	30	-	0.18	$97,279	-
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	30	-	0.21	$38,927	-
51-4121	Welders, Cutters, Solderers, and Brazers	30	-30	0.12	$47,911	$4,181

Source: Massachusetts EOLWD, OES; author's calculations. Wages in 2013 dollars.

tous supervisory and team assembler occupations. These occupations are also part of several other subsector core labor pools, including Paper and Printing. Like the overall subsector, the core occupations in the labor pool are significantly underrepresented in the region and with the exception of first-line supervisors. Occupational employment in the core labor pool has generally shrunk since 2001.

Wages of the core labor pool are higher across most core occupations, with the exception of team assemblers and cutting, punching, and press machine setters (Figure 14). Wage trends are somewhat erratic since 2001 and may be more the result of sampling error across years, rather than actual differences in occupational earnings (Table 7).

Figure 14
Difference in occupational earnings for workers in Fabricated Metals and Machinery v. regional average wage across all workers



Source: MA EOLWD, OES; author's calculations. In 2013 dollars.

Food Processing and Production

The Food Processing and Production subsector has a diverse occupational mix that is at times characteristic of other forms of manufacturing and at times more akin to food services and sales. Many of the core occupations in the Food Processing and Production subsector involve industrial food preparing and processing and are somewhat specialized to the subsector: bakers; food batchmakers; meat, poultry and fish cutters, and food-related machinery operators. The subsector is highly underrepresented in the region, despite the fact that comprises almost 10% of all Advanced Manufacturing employment. Table 8 presents employment and wage data for the occupations in the subsector's core labor pool. Driver/sales workers are the largest and most concentrated workers in the core labor pool and subsequently seen the largest change since 2001.

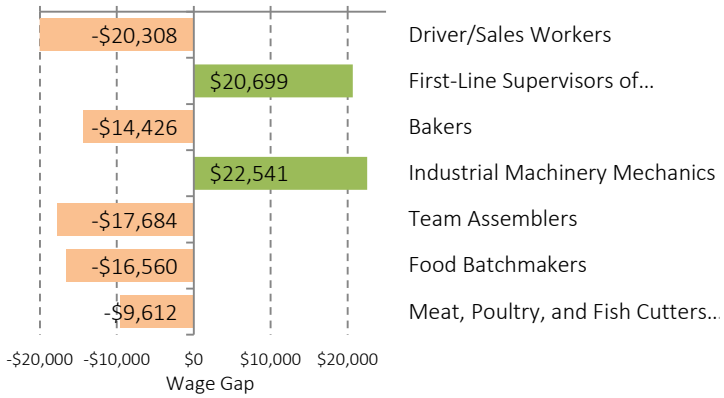
Table 8
Summary Employment and Earnings Statistics, Key Occupations in Food Processing and Production, 2012

		Employment			Real Wage	
SOC	Occupational Title	Number	Change from 01	Location Quotient	Per worker	Change from 01
53-3031	Driver/Sales Workers	400	230	1.32	$25,570	-$12,702
51-1011	First-Line Supervisors of Production and Operating Workers	190	80	0.43	$66,577	$4,305
51-3011	Bakers	120	-120	0.99	$31,452	-$3,010
49-9041	Industrial Machinery Mechanics	70	-	0.30	$68,419	$17,306
51-2092	Team Assemblers	70	-260	0.09	$28,194	-$11,719
51-3092	Food Batchmakers	60	-	0.78	$29,318	-
51-3022	Meat, Poultry, and Fish Cutters and Trimmers	40	20	0.33	$36,266	-$8,205

Source: Massachusetts EOLWD, OES; author's calculations. Wages in 2013 dollars.

Core labor pool wages follow similar patterns as in other regions, where most occupations, which tend to have lower skill and knowledge requirements, earn less than supervisory positions (Figure 15). Likewise, more specialized industrial machinery mechanics are high earning occupations and also have seen a significant increase in their real wages since 2001.

Figure 15
Difference in occupational earnings for workers in Food Processing and Production v. regional average wage across all workers



Source: MA EOLWD, OES; author's calculations. Wages in 2013 dollars.

Medical Equipment and Supplies

A majority of core occupations in Medical Equipment and Supplies are production oriented or engineering based occupations. The subsector shares a number of occupations with Fabricated Metals and Machinery, such as engineers, machinists, and other types of machine operators, while a handful of core occupations are specific to the subsector. In line with the state and other regions, Medical Equipment and Supplies make up a small share of overall regional Advanced Manufacturing employment in the Cape and Islands. The core labor pool in the region is comprised mainly of engineers, though medical appliance technicians are highly concentrated in the region (6.38). Wages follow similar patterns found elsewhere, with lower skilled workers earning wages below the regional average, while engineers command wages significantly higher (Figure 16).

Table 9

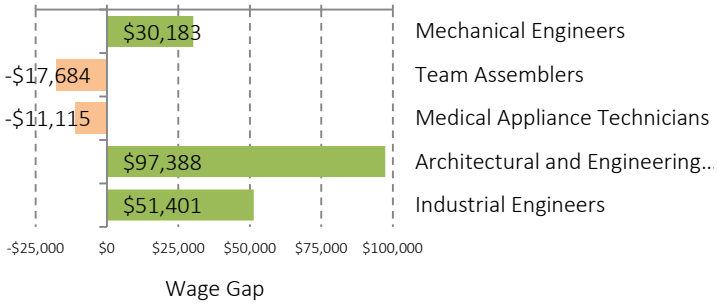
Summary Employment and Earnings Statistics, Key Occupations in Medical Equipment and Supplies, 2012

		Employment			Real Wage	
SOC	Occupational Title	Number	Change from 01	Location Quotient	Per worker	Change from 01
17-2141	Mechanical Engineers	70	0	0.36	$76,061	-$9,695
51-2092	Team Assemblers	70	-260	0.09	$28,194	-$11,719
51-9082	Medical Appliance Technicians	60	-	6.38	$34,763	-
11-9041	Architectural and Engineering Managers	50	-20	0.35	$143,266	$25,353
17-2112	Industrial Engineers	30	-	0.18	$97,279	-

Source: Massachusetts EOLWD, OES; author's calculations. Wages in 2013 dollars.

Figure 16

Difference in occupational earnings for workers in Medical Equipment and Supplies v. regional average wage across all workers



Source: MA EOLWD, OES; author's calculations. Wages in 2013 dollars.

Paper and Printing

Similar to other Advanced Manufacturing sectors, about half of Paper and Printing occupations are production oriented, although the subsector is distinct from other subsectors in that it has a small share of design and arts oriented workers that support it, while engineers which are typically present in most other subsectors, are not part of the core labor pool. The core occupations of the subsector are oriented towards printing press operations and are highly specific to paper goods and paper production. Given the small share of the subsector in the region, there is a select group of core occupations in the labor pool that are somewhat reflective of the broader statewide subsector. These include printing press operators, techni-

Table 10

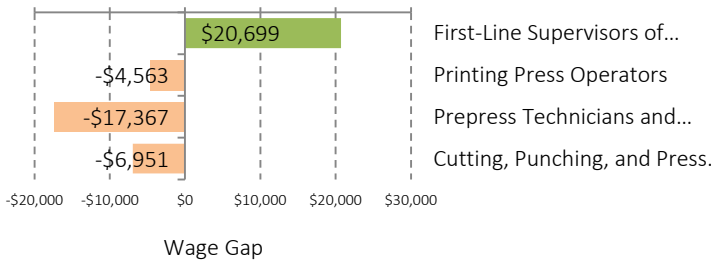
Summary Employment and Earnings Statistics, Key Occupations in Paper and Printing, 2012

		Employment			Real Wage	
SOC	Occupational Title	Number	Change from 01	Location Quotient	Per worker	Change from 01
51-1011	First-Line Supervisors of Production and Operating Workers	190	80	0.43	$66,577	$4,305
51-5112	Printing Press Operators	90	-	0.68	$41,315	-
51-5111	Prepress Technicians and Workers	70	-	2.20	$28,511	-
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	30	-	0.21	$38,927	-

Source: Massachusetts EOLWD, OES; author's calculations. Wages in 2013 dollars.

Figure 17

Difference in occupational earnings for workers in Paper and Printing v. regional average wage across all workers



Source: MA EOLWD, OES; author's calculations. In 2013 dollars.

cians, and machine setters and operators and for the most part are underrepresented, though technicians are fairly well concentrated in the region relative to national shares. These workers earn less than the regional average, and in the case of prepress technicians the difference is greater than $17,000 below the broader labor pool average.

Occupational Skills and Knowledge Requirements

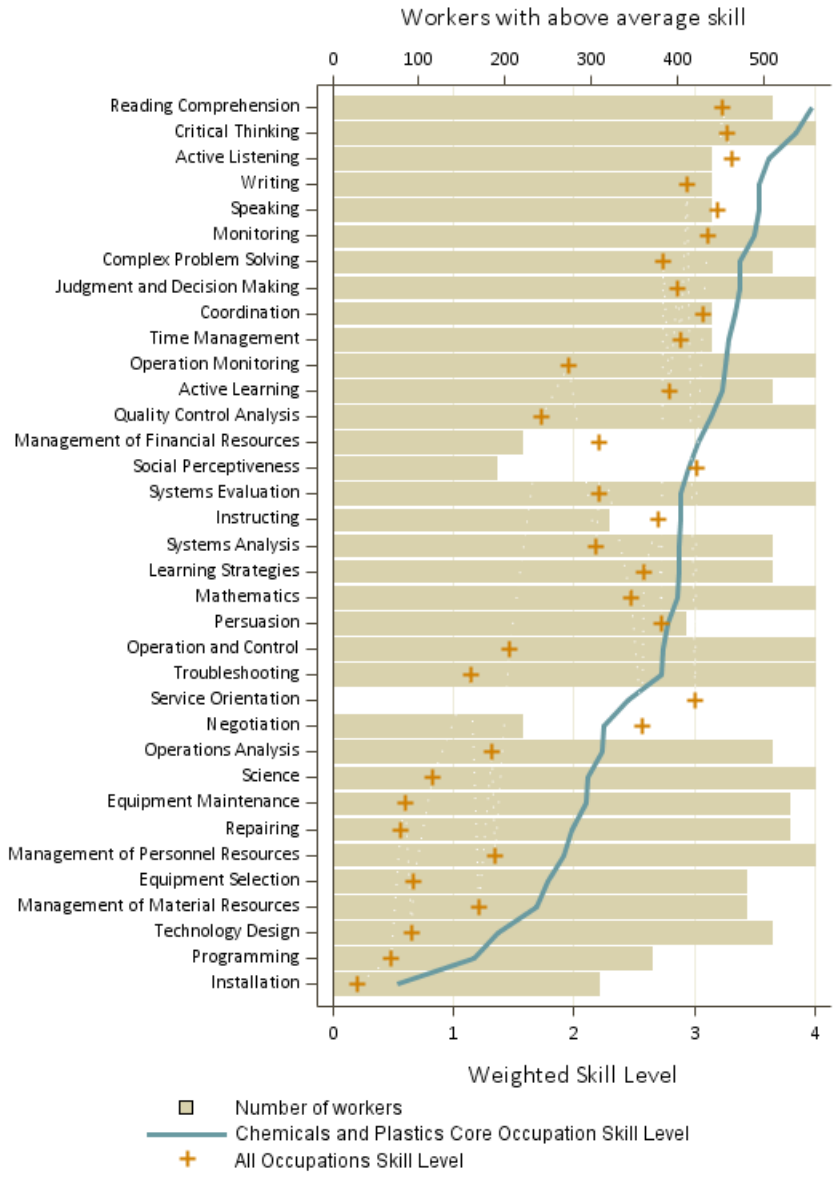
This section profiles the skill and knowledge stocks of workers in the Cape and Islands region across the six Advanced Manufacturing subsectors. As discussed in the state-level report, we link regional occupation employment data to the typical job requirements in 35 skill domains, as reported by the Bureau of Labor Statistics' Occupational Information Network (O*Net). As discussed in the previous section, industry-specific occupational data is not reported at the regional level. Thus, our analysis is more indicative of the skills of the overall labor force or potential labor pool, and not exclusively to workers in Advanced Manufacturing in the Cape and Islands region. For example, reported employment totals for industrial production managers include workers in Advanced Manufacturing as well as those working in other sectors: such as Transportation, Installation, and other areas.

To do this, we follow a similar method as the state level report for which we calculate a weighted average skill level based upon the employment totals and relative skill level reported in the O*Net for each subsector's core occupations, presented in the previous section. Average skill levels are then ranked from highest to lowest (top to bottom) and indicated by the blue line in each chart labeled "subsector core occupation skill level". Plus signs indicate the regional average skill score weighted across all occupations in all industries reported in the regional OES files. Finally, the horizontal bars indicate the number of workers in a particular subsector's core occupations that have an above average skill level, measured using the all occupation weighted average (plus signs) for each region. These measures help to identify strengths of potential labor pool for each subsector and Advanced Manufacturing across the Cape and Islands region. Knowledge requirements, characterized as post-secondary education, experience, on-the-job training, and in-plant training levels, are reported in years and as comparisons across subsector requirements. An 'all occupation' regional average is indicated by a vertical bar and provides a benchmark to compare subsector knowledge requirements to the broader regional labor pool. The remainder of this section presents the skill requirements for each subsector followed by the knowledge requirements of the regional labor pool.

Chemicals and Plastics

Skill requirements in Chemicals and Plastics are somewhat more diverse across skill sets compared to most other subsectors. The most prevalent skills are in the areas of quality control, equipment selection, operation and control, equipment maintenance, and repairing. However, workers in Chemicals and Plastics also have high requirements for basic skill sets, such as reading, critical thinking, active learning, and math.

Figure 18
Skill requirements in Chemicals and Plastics occupations



Source: MA EOLWD, OES; US BLS ONET; author's calculations.

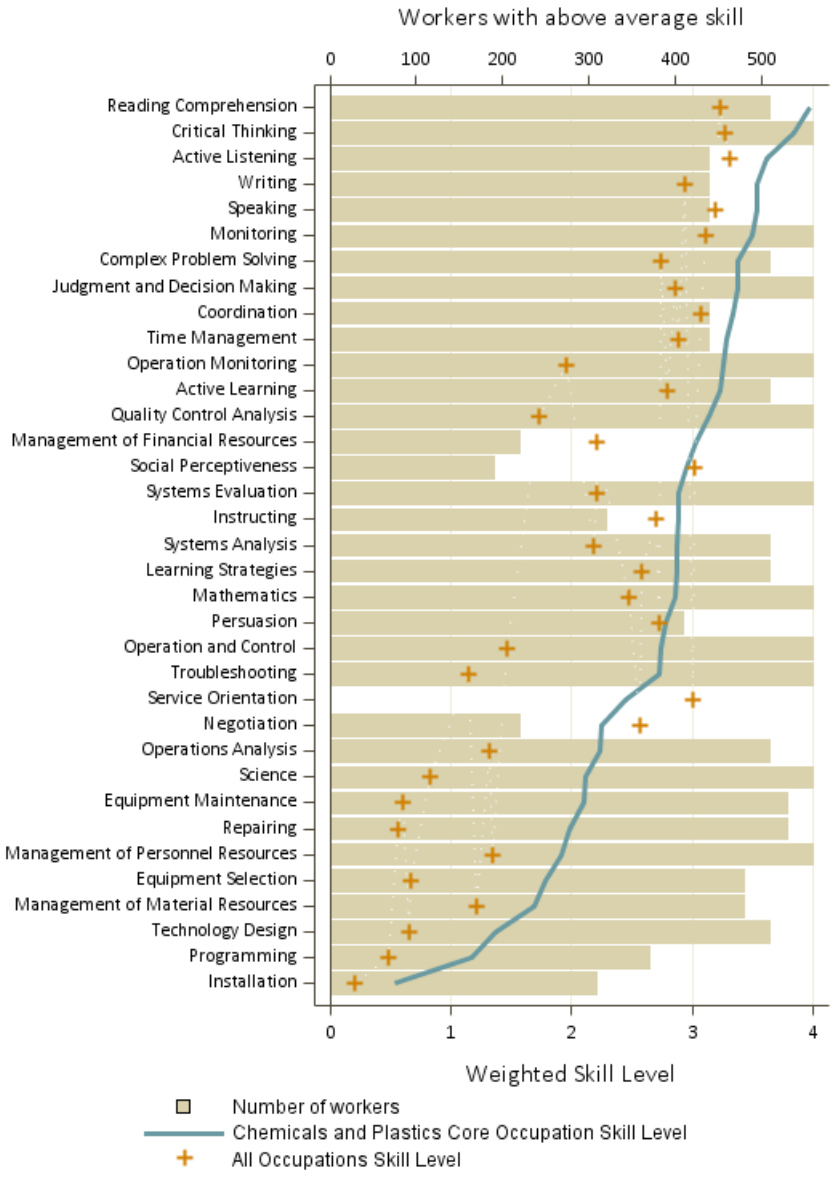
Given the limited number of occupations in the core labor pool, average skill levels are above the average for the region, with the exception of a few more intensive service oriented skill domains (Figure 18). The highest relative levels of the labor pool include basic learning and knowledge acquisition skills, as well as complex problem solving, judgment and decision making, and coordination; suggesting a labor pool well stocked in critical thinking and adaptive reasoning. The labor pool is also notably higher in the science domain, as well as the more technically oriented skills that include equipment maintenance and selection and repairing. Across a majority of skill domains, there are a large number of workers with above average skill requirements, which suggest the core labor pool in Chemicals and Plastics is more highly-skilled than worker in other sectors in the region.

Computers and Electronics

The core labor force in Computers and Electronics have the highest and most diverse skill requirements of the six subsectors. In line with the state level subsector, the regional core subsector labor pool's skill requirements are higher than the greater regional labor force across most all 35 skill domains. The skill profile of the core labor pool in Computers and Electronics closely aligns with Chemicals and Plastics, as well

as Medical Equipment and Supplies. Workers have above average skill requirements in all but service orientation (Figure 19). In particular, the core labor pool average is considerably higher than the region in the types of technical- and manually-oriented skills that are characteristic of Advanced Manufacturing work. Nevertheless, the highest skill levels of the core labor pool are in the basic cognitive and critical thinking skills that are important to innovation and learning. Given the rather small size of the core labor pool, we still find a relatively large number of workers with above regional average skill requirements, .

Figure 18
Skill requirements in Chemicals and Plastics occupations



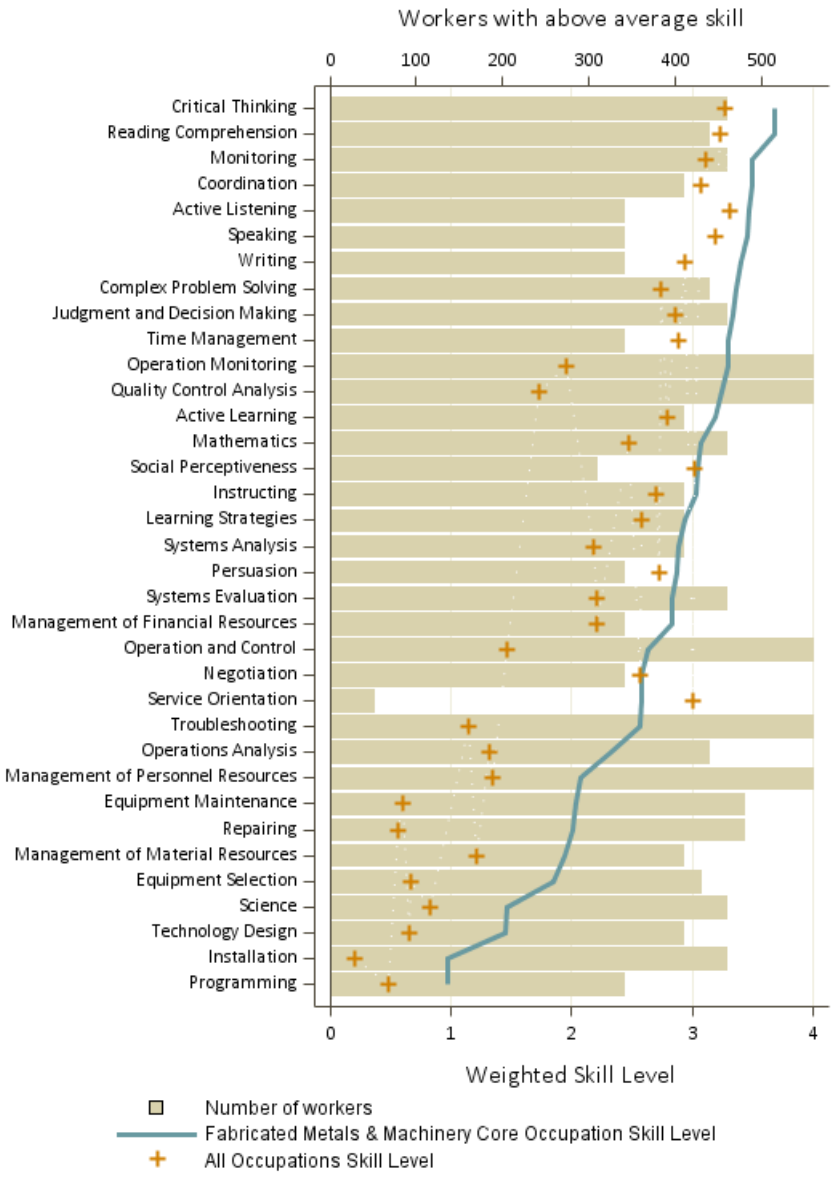
Source: MA EOLWD, OES; US BLS ONET; author's calculations.

Fabricated Metals and Machinery

The types of skills requiring high levels of knowledge in Fabricated Metals and machinery are primarily technical and technological—operations monitoring, monitoring, quality control, and operations. In addition, a number of key decision making and information-processing skills also appear among those requiring high levels, such as critical thinking, reading comprehension, problem solving, and judgment.

The core labor pool for Fabricated Metals in the Cape and Islands region, though somewhat smaller relative to other regions, is highly skilled and has a similar composition as the core labor pools for Computers and Electronics and Medical Equipment (Figure 20). This diverges from other regional patterns where the

Figure 20
Skill requirements in Fabricated Metals and Machinery occupations



Source: MA EOLWD, OES; US BLS ONET; author's calculations.

labor pool has lower skill levels than the regional averages. However, this might be more reflective of the relatively lower skill levels of the overall labor force in the Cape and Islands region. The highest skill levels are a combination of basic cognitive skills and manual activities that include coordination and monitoring. The core labor pool has somewhat more intensive skill stocks in many of the production and technically oriented skill domains, such as equipment handling, troubleshooting and quality control which speaks to the diverse mix of workers in the subsector.

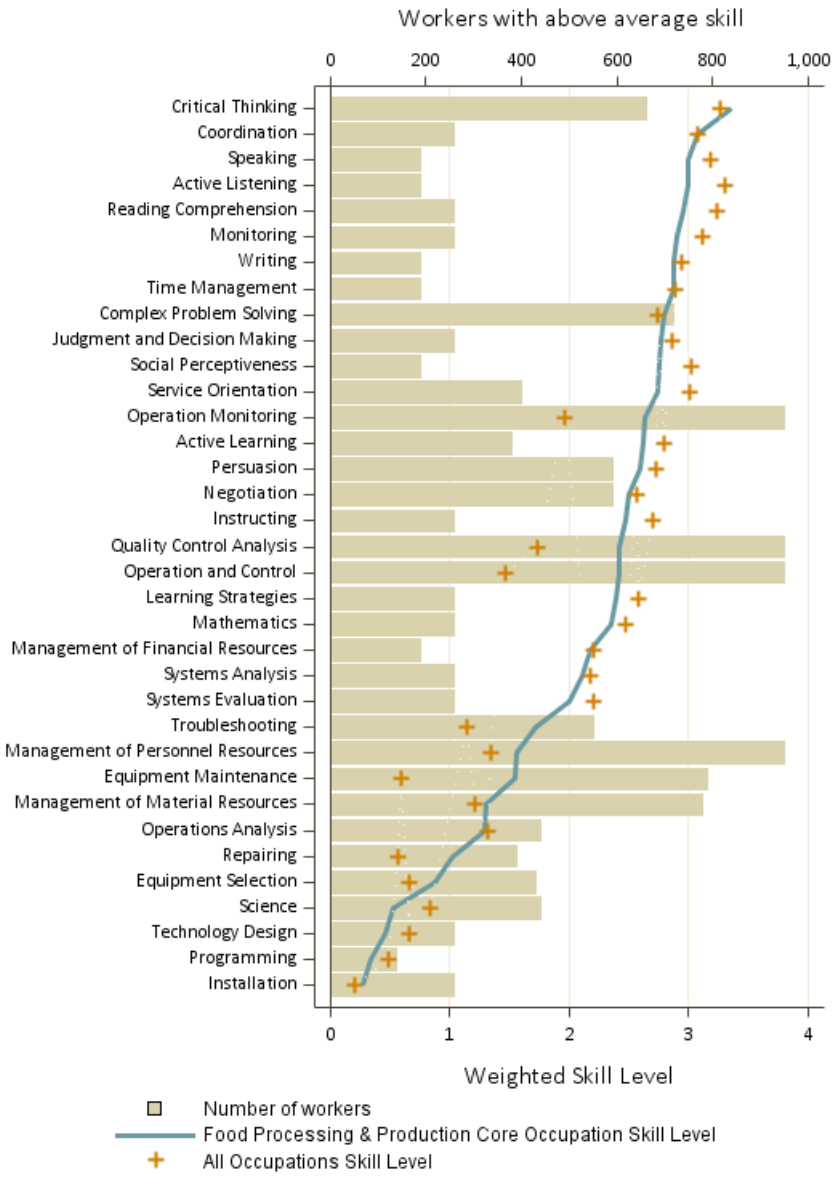
Food Processing and Production

On the whole, Food Processing and Production has few high-level skill requirements, and is characteristic of more traditional forms of low-skilled, routine forms of production. Basic skills dominate the rankings. The highest ranking skills are in the areas of critical thinking, coordination, speaking, listening and reading comprehension (Figure 21). The core labor pool for Food Processing and Production has lower skill levels than the regional average across a majority of domains. It matches the regional average in key areas such as critical thinking, coordination, writing, time management, and complex problem solving. It lags in overall workforce in many others, such as speaking, active listening, and reading comprehension. The only areas where the core labor pools exceeds the general workforce are in skills relat-

ed to equipment, operations, and quality control. We also see many areas where there are relatively few workers in occupations with above average skill levels, as identified by the length of the bars in Figure 21. The exceptions are in the areas where skills are fairly specialized and thus less common in the general labor pool, such as operations monitoring, quality control analysis, operation and control and management of personnel resources.

Given the small size of the Food Processing subsector and the number of potential workers in the core labor pool, the subsector might benefit from training programs that focus on important occupations, rather than specific skills. Some of these may also be complementary to industries outside Advanced Manufacturing, such as Food Services.

Figure 21
Skill requirements in Food Processing & Production occupations

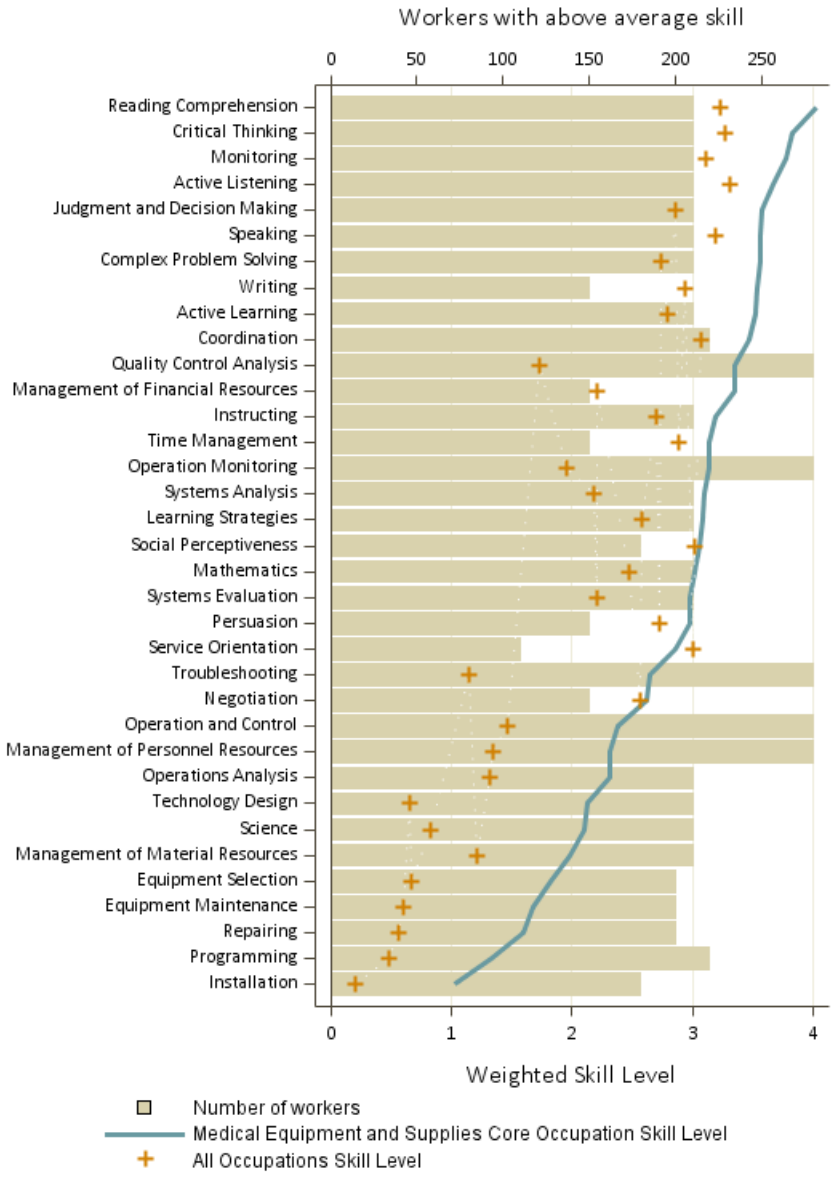


Source: MA EOLWD, OES; US BLS ONET; author's calculations.

Medical Equipment and Supplies

Medical Equipment and Supplies is the smallest of the six subsectors, but relatively high skill requirements across a number of technical, basic, and problem solving skill domains. There are many workers in occupations requiring above average skill levels and the range of skills represented are quite diverse. Among the most prominent skills are operation and control, instructing, quality control, technology design, equipment selection, and coordination. Though limited in size, the core labor pool in the Cape and Islands closely mirrors that of Computers and Electronics and Fabricated Metals, with above average skill levels across

Figure 22
Skill requirements in Medical Equipment and Supplies occupations



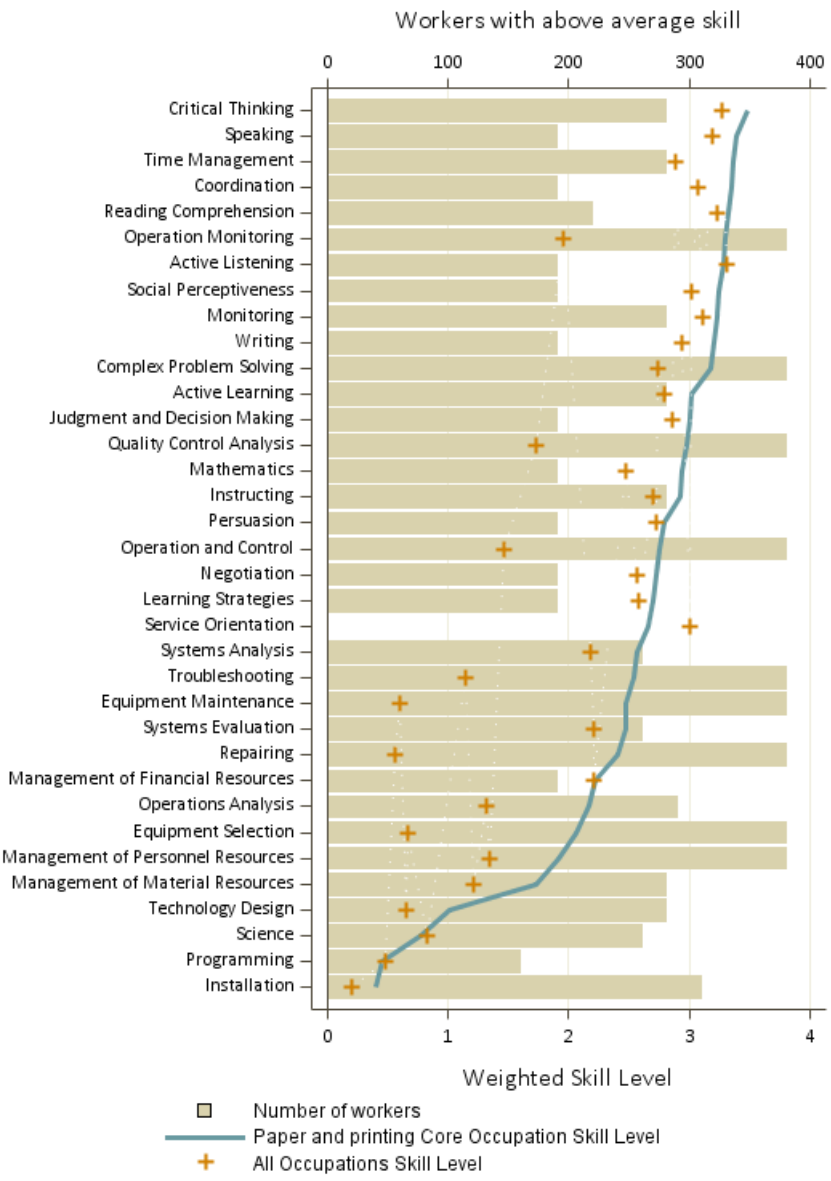
Source: MA EOLWD, OES; US BLS ONET; author's calculations.

most all domains (Figure 22). The highest skill levels are found in basic cognitive and critical thinking skills that facilitate learning and innovative activity. Despite the subsector's size, it is comprised of a small number of highly skilled workers that are versatile across most all skill domains.

Paper and Printing

The skills profile for the Paper and Printing subsector shares some characterized with Fabricated Metals and Machinery and Medical Equipment and Supplies in that many workers use production-oriented skills. The core labor pool of Paper and Printing in the Cape and Islands, have above average requirements across just about all skill domains, excluding service orientation (Figure 23). The subsector is somewhat distinct in that time management and social perceptiveness are among the most highly ranked skills in the subsector; suggesting the select group of workers in printing based occupations may be more adept to just in time work environments, such as those printing newspapers and other frequent periodicals. Given the small size of the core labor pool, there is a relatively high number of workers with above average levels in skills that are operation oriented (monitoring and control), equipment management, quality control and troubleshooting.

Figure 23
Skill requirements in Paper and Printing occupations



Source: MA EOLWD, OES; US BLS ONET; author's calculations.

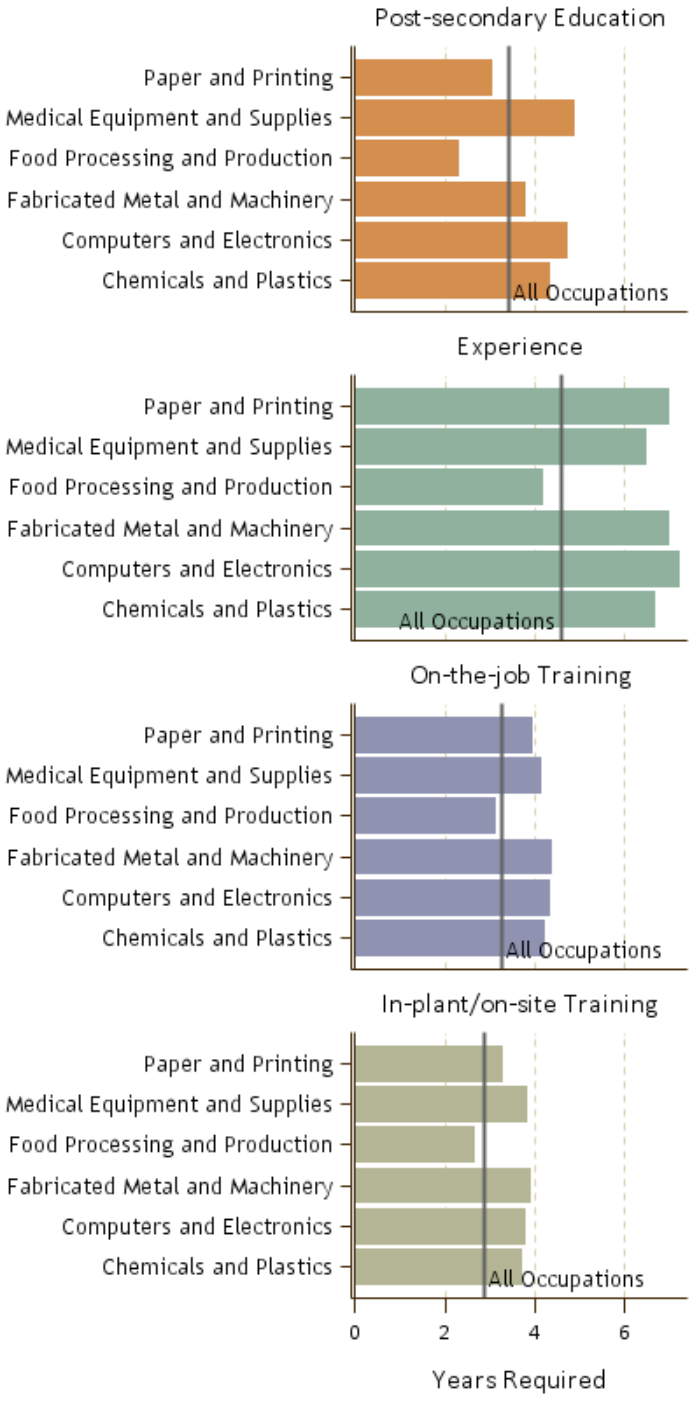
Experience, Education and Training

Figure 24 presents the experience, education and training requirements of the core labor pools across the six subsectors in the Cape and Islands region, reported as the average number of years required in each domain. Patterns of average requirements are comparable to statewide averages for each subsector, although often above the average requirements of the overall labor force in the region.

Medical Equipment and Supplies has the highest requirements in post-secondary education, at roughly five years, followed by Computers and Electronics and Chemicals and Plastics. Food Processing and Paper and Printing require less post-secondary education.

Advanced Manufacturing employers tend to have rather high experience requirements. With the exception of Food Processing, the core occupations of every subsectors have experience requirements greater than six years of prior industry experience. Computers and Electronics has the highest experience requirements, followed closely by Fabricated Metals and Paper and Printing. On-the-job and in-plant training requirements follow a similar pattern as industry experience. With the exception of Food Processing, and generally prefer between three to four years of on-the-job or on-site training.

Figure 24
Knowledge Requirements of Core Subsector Labor Pools



Source: Massachusetts EOLWD, OES; US BLS ONET; author's calculations.

In general, we find occupational requirements in the region's Advanced Manufacturing subsectors to follow state level averages where emphasis for knowledge acquisition is rooted in more applied and first-hand experience forms of knowledge uptake gained from learning-by-doing as opposed to formal classroom educational. Even so, we find the core labor pools in the Cape and Islands to have somewhat higher education requirements than other regional labor pools. However, this is more likely due to the low educational requirements in the regions dominate trade and leisure industries than high educational requirements in Advanced Manufacturing, per se. Training programs and workforce development initiatives may emphasize gaining hands on experience via apprenticeships or other mentoring programs, as well as formal training through which skills and knowledge specific to each subsector can be developed.

Profile of the Advanced Manufacturing Workforce

This final section looks at the people that work in the Advanced Manufacturing sector of the Cape and Islands Region in terms of race, gender, citizenship status, income, education, and commuting patterns. As in the state report, our demographic profile heavily relies on information from the American Community Survey Public Use Microsample (ACS PUMS) — a representative household survey conducted by the U.S. Census Bureau. It is important to keep in mind that the ACS PUMS is a sample, and not a full census count, and as such is prone to error. This is especially true in smaller regions and/or for analysis based on finely detailed subject categories where there is likely to be few survey respondents. While we provide some detailed estimates in Table 11 and the figures than follow, we warn the reader against interpreting our results as highly precise estimates, but should instead be thought of as revealing general tendencies and trends.

As a final note: our demographic profiles are based on slightly different regional definitions than the rest of the study. This is because the ACS PUMS does not use standard geographic jurisdictions (e.g. towns, counties, and metropolitan areas) but rather its own jurisdictions called PUMAs (Public Use Micros-ample Areas). While we deliberately design each PUMA-based region to closely match our standard (WIA-based) regional boundaries, some differences were unavoidable (Figure 25). In the case of the Cape and Islands the PUMS based boundaries are an identical match to the standard regional boundaries.

Figure 25
PUMS-Based Study Region Boundaries used in Demographic Analysis

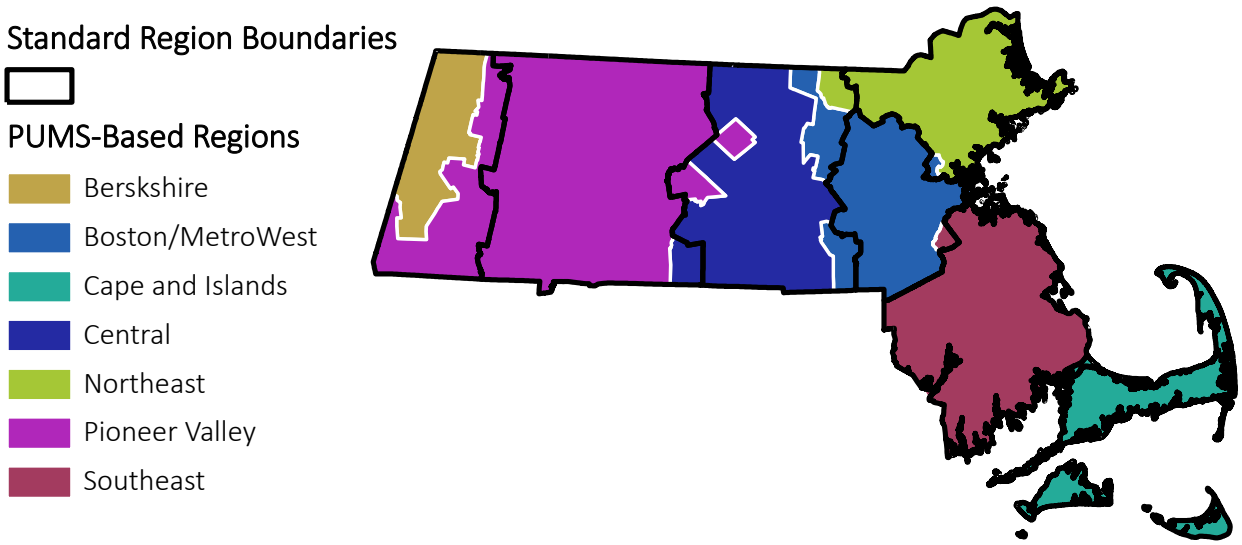


Table 11

Summary, Demographic Profile of the Advanced Manufacturing Workforce, Cape and Islands Region

	Advanced Manufacturing	Chemicals and Plastics	Computers and Electronics Products	Fabricated Metals & Machinery	Food Processing & Production	Medical Equipment and Supplies	Paper and printing	All Industries
Age								
Median	47.0	43.0	46.0	47.0	50.0	49.0	48.0	46.0
Under 25 years old	7%	21%	4%	4%	7%	9%	0%	10%
25 to 39 years	21%	18%	29%	16%	30%	18%	16%	24%
40 to 54 years	52%	56%	28%	55%	47%	73%	73%	38%
55 years or older	20%	5%	39%	26%	16%	0%	11%	28%
Race								
White	87%	69%	82%	100%	92%	84%	100%	94%
African American	1%	0%	0%	0%	4%	0%	0%	2%
Asian	5%	0%	15%	0%	0%	5%	0%	1%
Other	6%	20%	3%	0%	4%	11%	0%	1%
More than one race	2%	11%	0%	0%	0%	0%	0%	2%
Female	46%	60%	36%	34%	44%	80%	40%	49%
Place of Birth								
Massachusetts	55%	19%	47%	80%	57%	73%	74%	59%
Other New England	4%	8%	6%	3%	4%	0%	0%	8%
Other United States	23%	46%	24%	16%	28%	0%	9%	23%
Outside United States	17%	26%	23%	0%	10%	27%	17%	10%
Median Income (2012 dollars)								
Family Income	$81,312	$123,100	$82,959	$81,312	$62,500	$50,639	$71,300	$73,181
Personal Income	$45,167	$52,665	$74,498	$40,656	$27,443	$25,000	$30,492	$37,500
Wage and Salary Income*	$41,388	$52,665	$62,884	$40,656	$27,345	$15,246	$30,492	$30,000
Educational Attainment								
Less than High School	3%	0%	0%	4%	10%	11%	0%	4%
High School Diploma or GED	26%	29%	8%	30%	41%	47%	29%	25%
Associates Degree or Some College	25%	25%	19%	38%	23%	26%	17%	31%
Bachelors Degree or Higher	46%	45%	74%	29%	26%	17%	55%	40%
Commuting								
Ave. Travel Time to Work (mins)	19.2	17.6	16.7	24.0	19.1	20.5	19.1	20.2
Region/State of Primary Residence								
Berskshire	0%	0%	0%	0%	0%	0%	0%	0%
Boston MetroWest	1%	4%	0%	0%	3%	0%	0%	1%
Cape and Islands	91%	96%	89%	85%	97%	92%	83%	90%
Central	0%	0%	0%	0%	0%	0%	0%	0%
Northeast	0%	0%	0%	0%	0%	0%	0%	0%
Pioneer Valley	0%	0%	0%	0%	0%	0%	0%	0%
Southeast	8%	0%	11%	15%	0%	8%	17%	7%
Other State	0%	0%	0%	0%	0%	0%	0%	1%

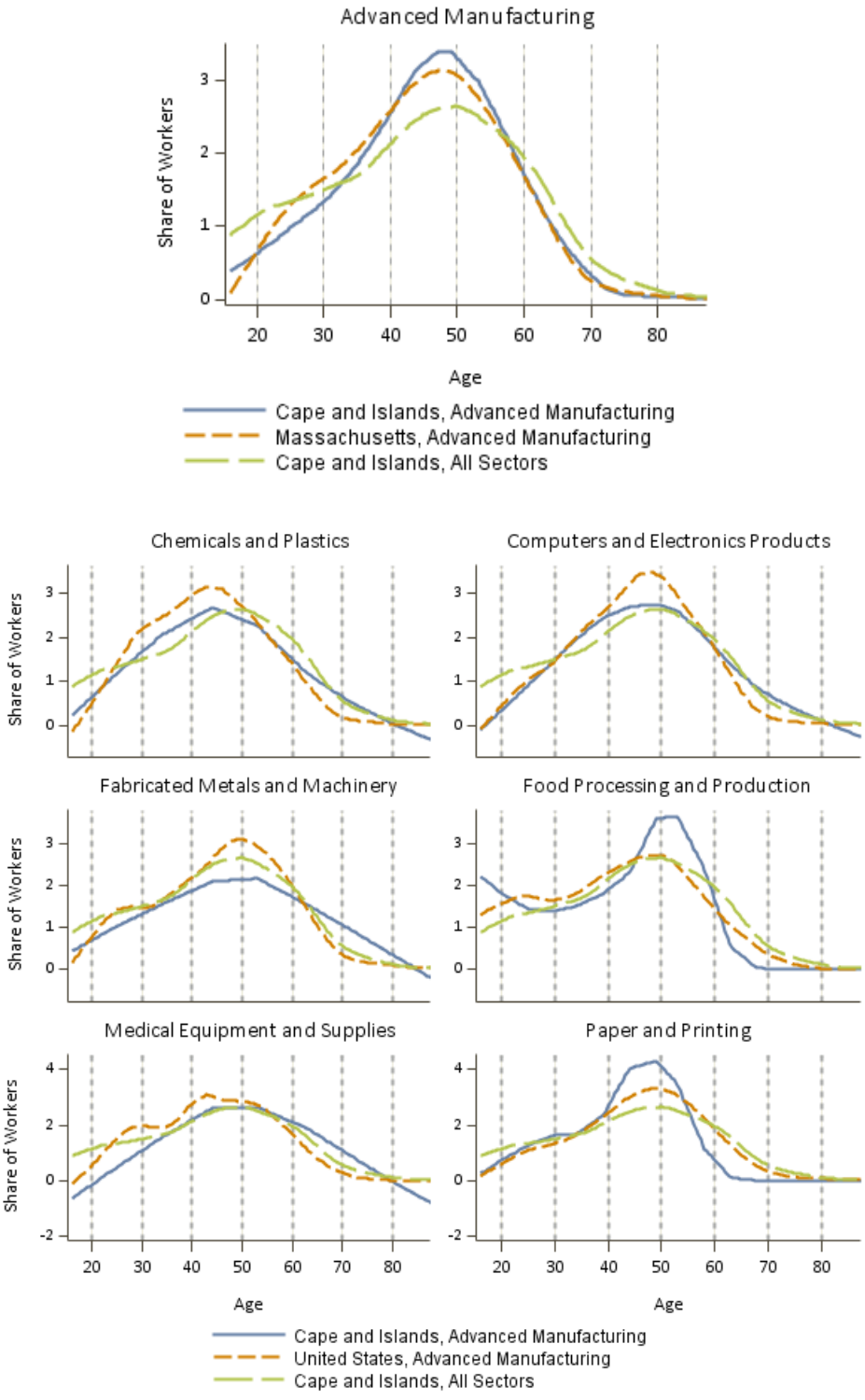
*Note: Wage and Salary Income reported in the ACS is different than the Total Wage and Salary reported from the Bureau of Labor Statistics and State Affliates. The ACS is based on a much smaller sample of the workforce and does not include the dollar value of benefits as reported in BLS employer surveys.

Age

The population of the Cape and Islands is among the oldest of any region in the Commonwealth. This is also reflected in its Advanced Manufacturing workforce. The typical worker in the Cape and Islands Advanced Manufacturing sector is 47, two years older than the Commonwealth (Table 11). Only the Berkshire region has a higher median age. Within the next twenty years, roughly 57% of the region's Advanced Manufacturing workforce will reach the traditional retirement age of 65 years. This is notably higher than the state average of 52% for the same age group. The Cape and Islands also has few workers under the age of 25 to help offset the lost knowledge and skills of anticipated retirees (Figure 26).

Among the individual subsectors, Medical Equipment and Supplies, Food Production, and Paper and Printing all

Figure 26
Age Distribution of the Advanced Manufacturing Workforce



Source: US Census Bureau, American Community Survey Public Use Micro Sample 2008-2012, Author's Calculations

have median ages that exceed the already high regional average. Chemicals and Plastics and Paper and Printing, will likely face the greatest difficulties associated with the aging workforce. By contrast, Food Process is characterized by a younger than average workforce, and impending retirements will likely cause little friction. The region's Fabricated Metals subsector is another interesting case, because its workforce skews considerably younger than it does in other regions of the Commonwealth—where it's typically among the oldest of all subsectors.

Race, Gender and Nativity

The overall workforce of Cape and Islands region is far less racially diverse than the balance of the Commonwealth, with approximately 94% of the population self-reported as "white alone." Against this backdrop, we find the Advanced Manufacturing workforce to actually be rather diverse, with a higher share of Asians, mixed race, and people of "other" races than the workforce as a whole (Table 11). Chemicals and Plastics, Computers and Electronics, and Medical Equipment and Supplies tend to be particularly diverse. However, the sample sizes of minorities in specific subsector can be very small and may not be accurate. The Advanced Manufacturing sector also has a slightly higher share of foreign born workers (i.e. those born outside the United States), again primarily in Chemicals and Plastics, Computers and Electronics, and Medical Equipment and Supplies.

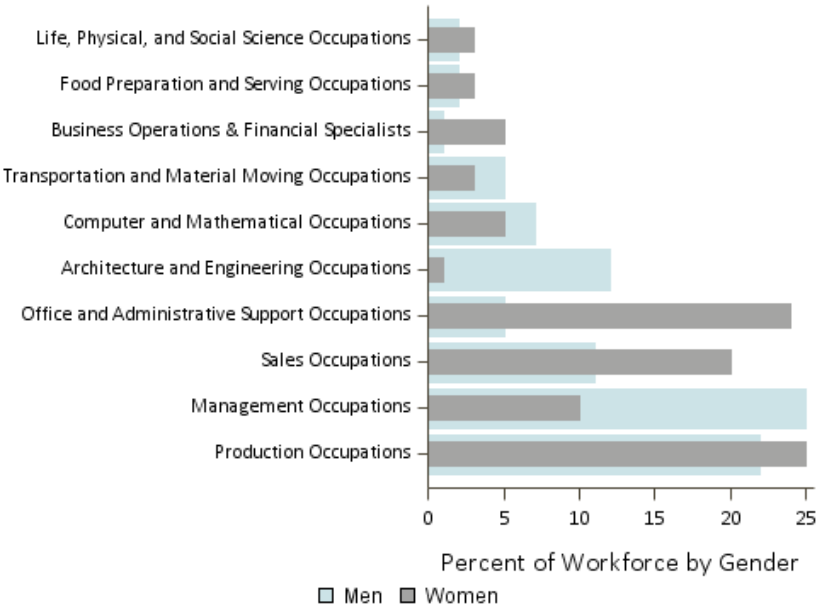
The Cape and Islands is the only region that comes anywhere close to a gender balance in its Advanced Manufacturing workforce. Statewide, women make up just 31% of all Advanced Manufacturing workers. In the Cape and Islands, 46% of all Advanced Manufacturing workers are women—just under the overall female labor participation rate of 49%. Women are particularly prevalent in the Chemicals and Plastics and Medical Equipment and Supplies subsectors where they make up a majority of all workers. There is still a sizable gender divide in Fabricated Metals and Computers and Electronics. Considering occupations, we find that women are most prevalent in occupations classified as production, office and administrative support, and sales (Figure 27). By contrast, men are far more prominent in architecture and engineering and managerial occupations.

Educational Attainment

Advanced Manufacturing workers in the Cape and Islands tend to have a fairly high rate of post-secondary education. Roughly 70% of the workers in the Cape and Islands' Advanced Manufacturing sector have at least some college education, compared to a statewide average of 66% (Table 11). This is also on par with the educational attainment rate of the overall regional workforce (71%). Among the seven subsectors, Computers and Electronics Products, Chemicals and Plastics, and Medical Equipment and Supplies have the highest share of the workforce with some college-level education.

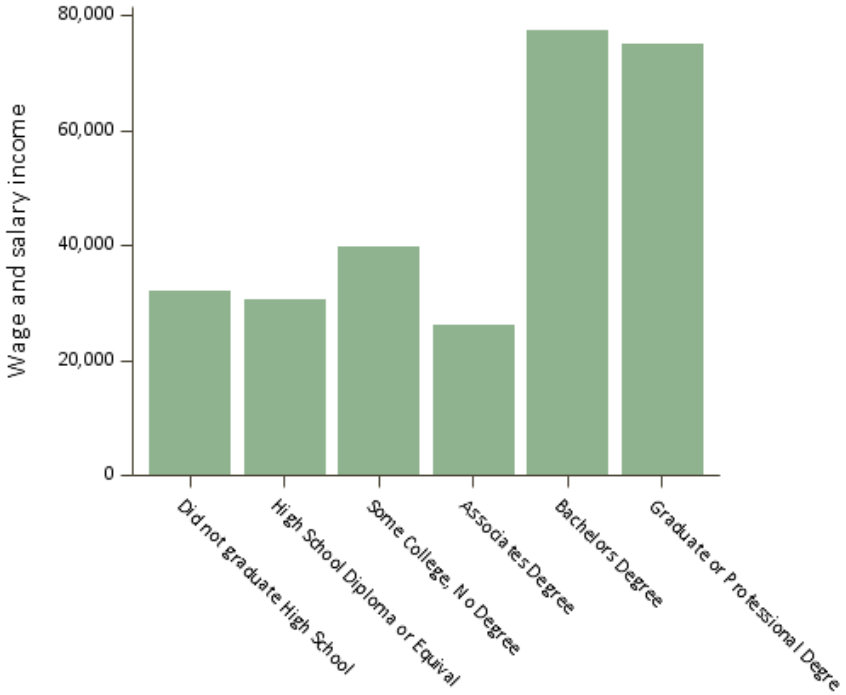
Consistent with elsewhere in the Commonwealth, workers with higher educational attainment levels earn considerably more than those without (Figure 28). There is a particularly large jump in wages for those who earn a Bachelors Degree, as this often denotes the distinction between shop floor workers and managerial/ professional staff.

Figure 27
Gender Differences by Major Occupation Groups in Advanced Manufacturing



Source: US Census Bureau, American Community Survey Public Use Micro Sample 2008-2012, Author's Calculations

Figure 28
Median Wage and Salary Earnings by Education, Advanced Manufacturing



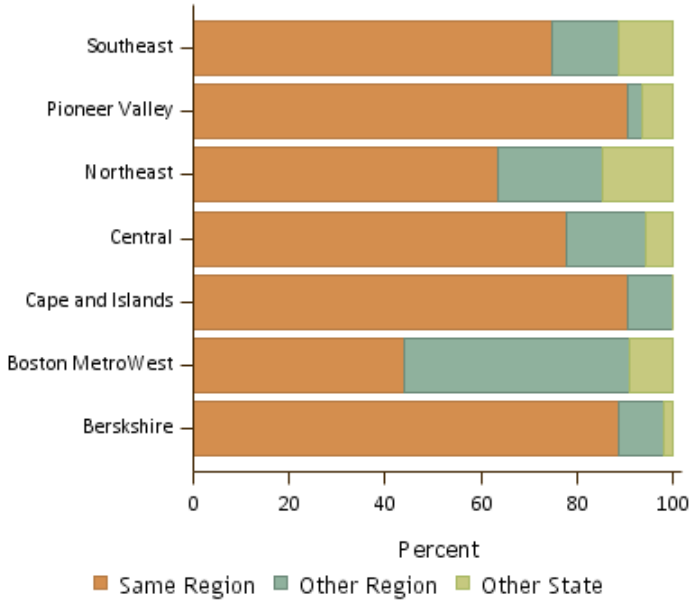
Source: US Census Bureau, American Community Survey Public Use Micro Sample 2008-2012, Author's Calculations

Residency and Commuting Patterns

Presumably due to is relative isolation, the Cape and Islands region has the highest rates of within -region residency of in the state (Table 11, Figure 29). Ninety-one percent of those who work in the region, live in the region. This means that a high proportion of the earnings of those working in the Advanced Manufacturing sector actually stay in the area to support local businesses. Advanced Manufacturing workers in the Cape and Islands also prefer to live close to where they work—the average one-way commute time of 19.2 is the lowest in the state. When workers due commute in from elsewhere, they are most likely to live in the Southeast region.

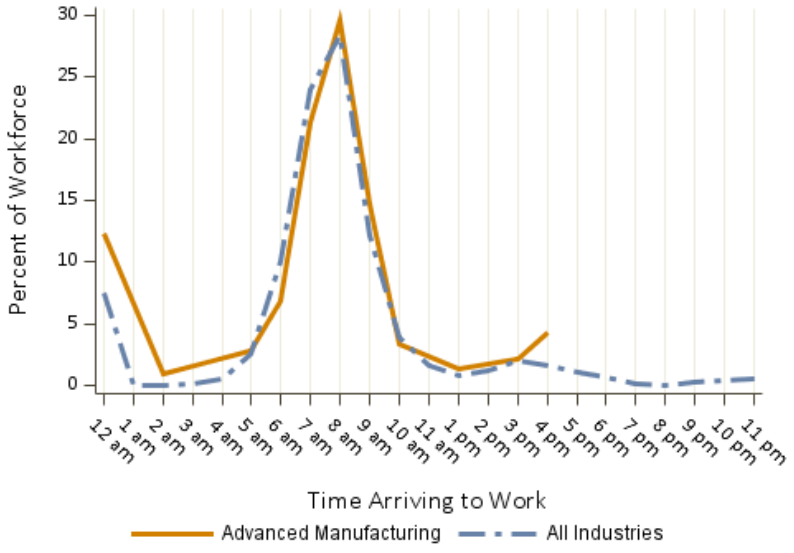
The typical worker in Advanced Manufacturing enjoys a relative standard work day, albeit with a notably earlier arrival time compared to the typical worker in the region (Figure 30). We also see a greater prevalence of third shift workers (starting time midnight).

Figure 29
Place of Residence by Region



Source: US Census Bureau, American Community Survey Public Use Micro Sample 2008-2012, author's calculations

Figure 30
Time Arriving to Work



Source: US Census Bureau, American Community Survey Public Use Micro Sample 2008-2012, author's calculations

Appendices

Appendix A

Advanced Manufacturing Subsector Definitions

Chemical & Plastics (incl. Pharmaceuticals)

NAICS	Description
3251	Basic chemical
3252	Resin, synthetic rubber, and artificial synthetic fibers
3253	Pesticide, fertilizer, and other agricultural chemical
3254	Pharmaceutical and medicine
3255	Paint, coating, and adhesive
3256	Soap, cleaning compound, and toilet preparation
3259	Other chemical product and preparation
3261	Plastics product

Fabricated Metal Products & Machinery

NAICS	Description
3321	Forging and stamping
3322	Cutlery and handtool
3323	Architectural and structural metals
3324	Boiler, tank, and shipping container
3325	Hardware
3326	Spring and wire product
3327	Machine shops; turned product; and screw, nut, and bolt
3328	Coating, engraving, heat treating, and allied activities
3329	Other fabricated metal product
3331	Agriculture, construction, and mining machinery
3332	Industrial machinery
3333	Commercial and service industry machinery
3334	Ventilation, heating, air-conditioning, and commercial ref
3335	Metalworking machinery
3336	Engine, turbine, and power transmission equipment
3339	Other general purpose machinery

Computer and Electronic Products

NAICS	Description
3341	Computer and peripheral equipment
3342	Communications equipment
3343	Audio and video equipment
3344	Semiconductor and other electronic component
3345	Navigational, measuring, electromedical, and control instruments
3346	Manufacturing and reproducing magnetic and optical media
3351	Electric lighting equipment

Food Processing and Production

NAICS	Description
3112	Grain and oilseed milling
3113	Sugar and confectionery product
3114	Fruit and vegetable preserving and specialty foods
3115	Dairy product
3116	Animal slaughtering and processing
3117	Seafood product preparation and packaging
3118	Bakeries and tortilla
3119	Other food

Paper and Printing

NAICS	Description
3221	Pulp, paper, and paperboard mills
3222	Converted paper product
3231	Printing and related support activities

Medical Equipment and Supplies

NAICS	Description
3391	Medical equipment and supplies

Appendix B

Regional Boundary Definitions